NEW APPROACH TO INTERPRETATION OF THE NATURE OF THE NAVIER-STOKES EQUATION AND ITS SOLUTION

Altayev N.K.
Kazakhstan, Shymkent

Annotation. The fundamental ideas of mathematical physics, which are accepted as the foundation in the attempt to solve the Navier-Stokes equation, by no means can be considered satisfactory, as the main results of the theory of infinite sets and theory of functions, developed as the direct consequence of the idea and results of this school, lead to obstacles.

Certainly, in this state of affairs there is a basis for assumption, that trying to obtain the solutions from the Navier-Stokes equation it is more reasonable to interprete its nature based on the ideas developed in the field of theoretical and empricial physics. On the other hand, analysis has shown, that the development of the foundations of theoretical and empirical physics still remain not satisfactory to become the fundamental ideas developed in these field to be used to solve such problems. Based on joint analysis the fundamental ideas of scientific philosophy of Descartes and equations since the times of Descartes obtained on the basis of mathematics and physics, there was completed the principal part of development of the foundations of theoretical and empirical physics. Only after that the new ideas developed on this path were accepted as the foundation for the interpretation of the nature of the equations of Euler and Navier-Stokes, as the solutions having the meaning of solution, obtained from Newton equations with the accuracy inherent to algebraic physics. The nature of the Hagen-Poiseuille formula for which it is possible to obtain the proof based on Navier-Stokes equations, was interpreted as the solution obtained with the help inherent to arithmetic physics.

New solutions, based on which it became possible to understand the nature of processes occurring in turbulent regime of flow, were obtained by generalization of Hagen-Poiseuille formula, while interpreting the nature of constants of viscosity based on the possibilities of new solutions, obtained from basic equations of statistical thermodynamics of Gibbs.

1. About the modern state of theoretical and empirical hydrodynamics and their difficulties. As it is known, after the Newton equation was obtained

$$\vec{F} = m\frac{d\vec{v}}{dt} \qquad (1)$$

there was obtained the Euler equation

$$\frac{\partial\vec{v}}{\partial t} + (\vec{v}\nabla)\vec{v} = -\frac{1}{\rho}\nabla p \qquad (2)$$

For ideal liquid and Navier-Stokes equation

$$\frac{\partial\vec{v}}{\partial t} + (\vec{v}\nabla)\vec{v} = -\frac{1}{\rho}\nabla p + \eta\Delta\vec{v} \qquad (3)$$

For the non-ideal liquid, where:ρ – density, p – pressure, $\vec{v}$ – vector of velocity, ∇ – Nabla operator, η – kinetic viscosity, Δ – Laplace operator.

After the analysis of experimental data by Hagen and Poiseuille there was obtained the expression of the form

$$Q = \frac{\pi R^4}{8\mu e}(p_1 - p_2) \qquad (4)$$

where: Q – energyexpense, $\frac{p_1 - p_2}{e}$ – pressure gradient, R – tube radii;

later it was shown, that based on equation (3) it is possible to obtain the analytic solutions, based on which it is possible to obtain the proof of (4).

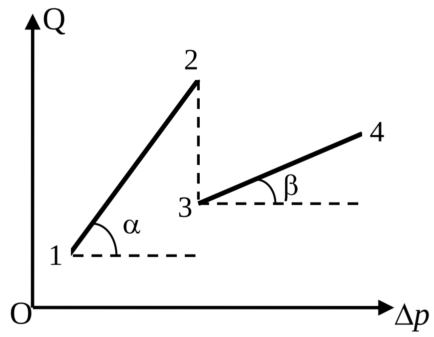


Рис. 1

It is known, that based on such solutions it is possible to explain the nature of laminar flow (fig 1), which coincides with the dependency determined by interval (1-2). But it is not possible to explain the nature of turbulent regime (interval 3-4).

There was made several attempts in order to obtain analytical solutions from equation (3), based on which it would be possible to understand the nature of turbulent regime of flow. But all such attempts did not lead to goal. Therefore, in such state of affairs, according to our views, it is reasonable to develop completely new approach to the solution of this problem, the essence of which is in the following.

As is known, talking about the link between Newton equation (1) and Euler equation (2), and also Navier-Stokes equation (3), we came to conclusion [1], that equations (2) and (3) are obtained as certain analog of equation (1). And we think, that such kind of understanding of the nature of relationship between equations (1), (2), (3) are not sufficient in order to understand their true nature. We suppose, that it is reasonable to prove, that equations (2) and (3) are equations having the meaning of solutions, obtained from equation (1) for the case of motion of the set of particles under the action of external force

∇p in the first case, and also the force ∇p and force of resistance $\eta\Delta v$ in the second case.

According to our views in order to think in such aspect, there should exist certain foundation that relations of Hagen and Poiseuille (4) at their time were obtained based on analysis of experimental data. That is why this relation has the meaning of solution, obtained for interrelationship between observed, i.e. measured values with the accuracy of empirical physics. Hence, the equations of mathematical physics (2) and (3), based on which it is possible to prove the relation (4) also should have the meaning of solution, obtained from equation of Newton (1).In other words, we believe, that until present time there was not obtained the satisfactory answer to the question of the following content:

Which results should be accepted as solution, obtained from equation (1) for the case, when it is accepted as the foundation of description of problem of many particles?	(5)

We believe, that if the correct answer is obtained, then based on new ideas and results, which were obtained on this path, it should become possible to correctly understand the true nature of equations (2) and (3). According to our view, there emerges the possibility of deeper understanding of the nature of the solution, obtained from equation (3) for the substantiation of relation (4).

There is a basis for supposing, that all such new ideas and results open the path for obtaining rigorous solutions, based on which it will be possible to understand the nature of turbulent flow.

2. On the question, how the analysis of fundamental results, obtained based on mathematical physics, we tried to obtain the answer to the question (4) and why it was not possible to achieve this goal. Here speaking about the fundamental results obtained based on mathematical physics, we mean equations

$$\frac{\partial^2 u}{\partial t^2} - a^2 \frac{\partial^2 u}{\partial x^2} = 0 \qquad (6)$$

…………………

$$\frac{\partial^2 u}{\partial t^2} - a^2 \Delta u = 0 \qquad (7)$$

and

$$\frac{\partial u}{\partial t} - a^2 \frac{\partial^2 u}{\partial x^2} = 0 \qquad (8)$$

…………………

$$\frac{\partial u}{\partial t} - a^2 \Delta u = 0 \qquad (9)$$

And solutions of the type

$$\begin{aligned} &a)\ u(x,t) = \sum_{n=1}^{\infty} q_n(t) \sin\frac{n\pi x}{\ell}, \\ &б)\ \ddot{q}_n + \omega_n^2 q = 0, \\ &в)\ \omega_n = \frac{n\pi a}{\ell}, \end{aligned} \qquad (6')$$

Obtained as solutions of equation (6) and expressions of the type

$u = u_0 \sin(\omega t - \varphi) \sin K_x \cdot x \cdot \sin K_y \cdot y \cdot \sin K_z \cdot z$, where $K_x L = n\ell, \quad K_y L = nm, \quad K_z L = \pi n,$ while ℓ, m, n – any integer numbers, and ω is related to K_x, K_y, K_z by relations $K_x^2 + K_y^2 + K_z^2 - \frac{\omega^2}{c^2} = 0$ or $\omega = \omega_{\ell,m,n} = c\sqrt{K_x^2 + K_y^2 + K_z^2} = c\frac{\pi}{L}\sqrt{\ell^2 + m^2 + n^2}$,	(7′)

Obtained as particular solution for the equation (7), for the case, when in the quality of boundary condition $u = 0$ on the boundaries of cube with the edge L, and expression of the type

$$u=\sum_{\ell=1}^{\infty}\sum_{m=1}^{\infty}\sum_{n=1}^{\infty}\psi_0\sin(\omega t-\varphi)\sin K_x\cdot x\cdot\sin K_y\cdot y\cdot\sin K_z\cdot z, \quad (7'')$$

Obtained as the general solution of equation (7), in turn, written in the form of sum of solutions of the type (6′,a) withall possible values ℓ,m,n, where the energy can be expressed as the sum of energy of abstract oscillators:

$$\ddot{q}_{\ell mn}+\omega^2_{\ell mn}\cdot q_{\ell mn}=0, \qquad (7''')$$

And the number of nodes of crystal lattice, located in one octant inside the sphere is determined by the expression

$$dN(\omega)=\frac{\omega^2 V}{2\pi^2 a^3}d\omega. \qquad (7'''')$$

Where the number of abstract oscillators, having the frequencies, are in the interval from ωtoω + dω, and also solutions of the type

$$u(x,t)=\sum_{n=1}^{\infty}\varphi_n\sin\frac{n\pi x}{\ell}e^{-\frac{n^2\pi^2a^2}{\ell^2}t},$$
$$\varphi_n=\frac{2}{\ell}\int_0^{\ell}\varphi(x)\sin\frac{n\pi x}{\ell}dx \qquad (8')$$

Obtained as the solution of the equation of the type (8), and expressions of the type

$$\boxed{\begin{array}{l} u_{kmn}(x,y,z,t)=e^{-a^2\lambda_{kmn}t}\sin K_x\cdot x\cdot\sin K_y\cdot y\cdot\sin K_z\cdot z\,; \\ \lambda_{kmn}=\left(\frac{k\pi}{L}\right)^2+\left(\frac{mn}{L}\right)^2+\left(\frac{n\pi}{L}\right)^2; \\ K_x=\frac{k\pi}{L},\quad K_y=\frac{m\pi}{L},\quad K_z=\frac{n\pi}{L}, \end{array}} \qquad (9')$$

Which were obtained as the special solution for the equations (9) and

$$u(x,y,z,t)=\sum_{k,m,n=1}^{\infty}A_{kmn}e^{-a^2n^2\left(\frac{k^2}{L^2}+\frac{m^2}{L^2}+\frac{n^2}{L^2}\right)t}\cdot\sin\frac{k\pi x}{L}\cdot\sin\frac{m\pi y}{L}\cdot\frac{n\pi z}{L}, \qquad (9'')$$

where

$$A_{kmn}=\frac{8}{L^3}\int_0^L d\xi\int_0^L d\zeta\int_0^L f(\xi,\zeta,\eta)\sin\frac{k\pi\xi}{L}\cdot\sin\frac{m\pi\zeta}{L}\cdot\sin\frac{n\pi\eta}{L}d\eta\,,$$

Which were obtained as the general solution of the equation (9) taking into account the conditions:

$$\boxed{\begin{array}{c} 0\le x<L,\quad 0<y<L,\quad 0<z<L\,; \\ u\big|_{x=0}=u\big|_{x=\ell}=u\big|_{y=0}=u\big|_{z=0}=u\big|_{z=1}=0\,; \\ u\big|_{t=0}=f(x,y,z),\quad 0\le x\le\ell,\quad 0\le y\le L,\quad 0\le z\le L\,. \end{array}} \qquad (9''')$$

There is a basis to suppose that at their time equations (6), (7) and (8) (9) and also all solutions of these equations were obtained by mathematicians with the goal to deeply understand the nature of :

α) vibrational and wave processes;

β) heat and diffusion processes.

But, as it is known, based on solutions of the type (6′), (7′)-(7″″) and (8′), (9′)-(9″′), obtained from equations (6), (7) and (8), (9) it was not possible to attain this goal. But, ithappenedthatinspiteofthefactthatthesesolutionsfromequations(6), (7) and (8), (9) were obtained as analytical, but their application to the description of natural processes did not lead to the solution of problems of typeαandβ. Certainly under such state of affairs, the reason of the fact, why based on these solutions it was not possible to explain the nature of vibrational-wave and heat, diffusion processes there should be one reason. Thisispossibleonlyincase, when uponthederivationofinitialequations (6), (7) and (8), (9) there were made certain mistakes, for instance, due to not entirely correct account of peculiariaties of physics of processes.

In the past mathematicians understood that based on possibilities of solutions (6′), (7′),(7″) and (8′), (9′), (9″) it was not possible to deeply understand the nature of phenomena of type α andβ, but, they didn’t understand that the goal is not achieved. Onthecontrary, theyacceptedequations(6), (7) and (8), (9) as true, the same astheir solutions (6′), (7′),(7″) and (8′), (9′), (9″), obtained on their basis. On the other hand, there is a known fact that on this path, where such results were accepted to be true, there appeared difficulties, for instance, inherent to the results, obtained in such fields as theory of functions and theory of infinite abstract sets. Hence, having in mind all this, we think, that there is a foundation to assume, that upon the derivation of equations (6), (7) and (8), (9) there were made certain mistakes, and also that we still not correctly understand the nature of these equations and solutions.

Itseemstous, thatundersuchstateofaffairs, whenbasedonanalysisofmainequationsofmathematicalphysics (6), (7) and (8), (9) and their solutions, there is a difficulty in arriving to understanding the nature of vibrational-wave and heat, diffusion processes, there is a possibility to conclude that all such results are not entirely sufficient in order to obtain correct answer to question (5) based on their analysis.

3. On the question, why by analysis of ideas and equations, developed in the field of theoretical and empirical physics, we tried to obtain the answer to the question (5) and why it was not possible to achieve this goal. Here talking about the fundamental equations of theoretical physics, in general we have in mind the equation of dynamics of Newton (1) and equations of dynamics of Hamilton

$$\dot{q}_i = \frac{\partial H}{\partial p_i}, \quad \dot{p}_i = -\frac{\partial H}{\partial q_i}, \qquad (10)$$

And also the fundamental equations of Hamilton-Jacobi-Schrodinger theory

$$\boxed{\begin{aligned}&\frac{\partial S}{\partial t}+H\left(q_i,\frac{\partial S}{\partial q},t\right)=0,\\&H\left(q_i,\frac{\partial S}{\partial q}\right)=E,\\&\Delta\psi+\frac{8\pi^2 m}{\hbar^2}(E-V)\psi=0,\end{aligned}} \qquad (11)$$

And fundamental equations of statistical mechanics of Gibbs

$$\boxed{\begin{aligned}&a)\ \ \frac{\partial\rho}{\partial t}-[H\rho]=0,\\&б)\ \ [H\rho]=0,\\&в)\ \ \rho_i=\exp\frac{F-\varepsilon_i}{kT},\\&г)\ \ \rho_{i,n}=\exp\frac{\Phi+\mu n-\varepsilon_i}{kT},\end{aligned}} \qquad (12)$$

where:H – hamiltonian, S – action, ψ – wave function, V – potential energy, ρ – Gibbs probability density.

Talking about the fundamental equations of empirical physics, we have in mind that the fundamental equations of Maxwell electrodynamics

$$\boxed{\begin{aligned}&\nabla^2\vec{E}-\frac{1}{c^2}\frac{\partial^2\vec{E}}{\partial t^2}=0,\\&\nabla^2\vec{H}-\frac{1}{c^2}\frac{\partial^2\vec{H}}{\partial t^2}=0,\end{aligned}} \qquad (13)$$

And solutions of the type

$$\boxed{\begin{aligned}&E_x=A_x\cos(\omega t-\varphi)\cos K_x x\cdot\sin K_y y\cdot\sin K_z z,\\&E_y=A_y\cos(\omega t-\varphi)\sin K_x x\cdot\cos K_y y\cdot\sin K_z z,\\&E_z=A_z\cos(\omega t-\varphi)\sin K_x x\cdot\sin K_y y\cdot\cos K_z z,\\&H_x=B_x\sin(\omega t-\varphi)\sin K_x x\cdot\cos K_y y\cdot\cos K_z z,\\&H_y=B_y\sin(\omega t-\varphi)\cos K_x x\cdot\sin K_y y\cdot\cos K_z z,\\&H_z=B_z\sin(\omega t-\varphi)\cos K_x x\cdot\cos K_y y\cdot\sin K_z z,\\&\ddot{q}_{\ell mn}+\omega^2_{\ell mn}q_{\ell mn}=0,\\&N(\omega)=\frac{\omega^2 V}{3\pi^2 c^2},\end{aligned}} \qquad (14)$$

Which are obtained from these equations.
We have in mind also the wave equation of Schrodinger

$$\Delta\psi+\frac{8\pi^2 m}{\hbar^2}(E-V)\psi=0, \qquad (15)$$

Which was obtained at first in the field of empirical physics with the aim of deriving the proof of Bohr relations

$$E_a = -\frac{mc^4}{2h^2} \cdot \frac{1}{n^2} \qquad (16)$$

And de-Broigle

$$2\pi r = n\lambda. \qquad (17)$$

We have in mind also the fundamental equations of technical thermodynamics

$$\boxed{\begin{aligned} &dU = TdS - PdV, \\ &dH = TdS - VdP, \\ &dF = -SdT - PdV, \\ &dG = -SdT - VdP, \\ &P = P', \;\; T = T', \end{aligned}} \qquad (18)$$

And chemical thermodynamics

$$\boxed{\begin{aligned} &dU = TdS - PdV + \sum \mu dn_i, \\ &dH = TdS - VdP + \sum \mu dn_i, \\ &dF = -SdT - PdV + \sum \mu dn_i, \\ &dG = -SdT - VdP + \sum \mu dn_i, \\ &P = P', \;\; T = T', \;\; \mu = \mu', \end{aligned}} \qquad (19)$$

And also the relations of the type

$$\boxed{\begin{aligned} &n = A\exp\frac{-\varepsilon_i}{kT}, \\ &S = k\ln W + \mathrm{const}, \end{aligned}} \qquad (20)$$

ObtainedinthefieldofMaxwell-Boltzmannstatistics

$$\boxed{\begin{aligned} &а)\;\; S = k\ln W, \\ &б)\;\; W = \frac{(N+P-1)!}{(N-1)!P!}, \\ &в)\;\; E = p\varepsilon, \\ &г)\;\; E = N\bar{u}, \\ &д)\;\; \bar{u} = \frac{\varepsilon}{\exp\frac{\varepsilon}{kT} - 1}, \end{aligned}} \qquad (21)$$

Obtained in the field of quantum theory of Planck and also relations of the type

$$\boxed{\begin{aligned} &а)\, K = \frac{n_{AB}}{n_A \cdot n_B}, \\ &б)\, \theta = \frac{bn_A}{1 + bn_A}, \end{aligned}} \qquad (22)$$

Widely used in the field of physical chemistry

In all these expressions: EиH – strength of electric and magnetic fields, ψ – wave function, U – internal energy of system, N – enthalpy, F – free energy, G – thermodynamic potential, S – entropy, P – pressure, V – volume, T – temperature, μ – chemical potential, θ – degree of filling, b – adsorption constant, К – equilibrium constant, n_A, n_B– concentration of particles of type A and B, n_{AB} – concentration of complex AB,ρ_ν – density of radiation, ν, ω – frequency, $\bar{u}$ – average energy of oscillator.

There is a basis to assume, that physicists the same as mathematicians in the process of obtaining the main equations of mathematical physics and fundamental equations of theoretical physics (11), (12) and also the fundamental equations of empirical physics (13)-(17) and (18)-(22) obtained them in order to deeply understand the physical nature of α) vibrational and wave processes and nature β) heat and diffusion processes.

There is also the basis to assume, that they would succeed to achieve the goal, if based on equations (11) and (12) it would become possible to obtain solutions, which could be accepted as the proof of equations (13)-(17) and (18)-(22), obtained in the field of empirical physics. But, as it is known, in the past, physicists didn't succeed to achieve completion of such program. In order to comprehend, that this is true, it is important to draw attention to structural peculiarity of the following scheme:

Engineering thermodynamics	***Chemical thermodynamics***	***Chemical equilibrium***
$dU = TdS - PdV,$ $dH = TdS - VdP,$ $dF = -SdT - PdV,$ (18) $dG = -SdT - VdP,$ $P = P', \quad T = T',$	$dU = TdS - PdV + \sum \mu dn_i,$ $dH = TdS - VdP + \sum \mu dn_i,$ $dF = -SdT - PdV + \sum \mu dn_i,$ (19) $dG = -SdT - VdP + \sum \mu dn_i,$ $P = P', \quad T = T', \quad \mu = \mu',$	$K = \dfrac{n_{AB}}{n_A \cdot n_B},$ (22) $\theta = \dfrac{bn_A}{1 + bn_A}$
$\rho_i = \exp\dfrac{F - \varepsilon_i}{kT},$ (12,в)	$\rho_{i,n} = \exp\dfrac{\Phi + \mu n - \varepsilon_i}{kT},$ (12,г)	? (23)
$d\varepsilon = -\theta d\bar{\eta} - \sum \bar{A}_1 da_1,$ $d\psi = -\bar{\eta} d\theta - \sum \bar{A}_1 da_1,$ (24)	$d\bar{\varepsilon} = -\theta d\bar{H} - \sum \bar{A}_1 da_1 + \sum \mu d\bar{u},$ $d\bar{\psi} = \bar{H} d\theta - \sum \bar{A}_1 da_1 + \sum \mu d\bar{u}$ (25)	?(26)

InspiteofthefactthatGibbsbasedonapplicationofpossibilitiesof(12,c), (12,d), obtainedbyhiminthefieldofstatisticalmechanics, succeededtoobtainthesolutions(24) and (25), which can be accepted as the proof of corresponding equations, obtained earlier in the field of engineering thermodynamics and chemical thermodynamics, but its program remained not completely finalized in the sense that based on fundamental equations of statistical thermodynamics they didn't obtain the solutions, which would serve as the proof of expressions (22,a) and (22,b).As it is known, until present time there is an absence of complete clarity in all problems, whose solution use the expressions (20), (21), (22). There is a basis to suppose that the reason of this is that based on equations of Gibbs statistical mechanics there is still the lack of sharp proof of such expressions (20), (21), (22). That is why it is possible to conclude, that the problem of clarification of true nature of heat and diffusion processes remains incomplete.

As was stated above, in the past Schrodinger obtained equation (15) working in the field of empirical physics, namely with the goal of disclosure of physical meaning of Bohr relation (16) and de-Broigle (17). After that, within the possibilities of ideas, inherent to optical-mechanical analogy it was shown, that such equation (15) can be accepted as the consequence of fundamental equations of the theory of Hamilton-Jacobi (11,a) and (11,b) obtained by him from the fundamental equation of Hamilton in the dynamics (10).

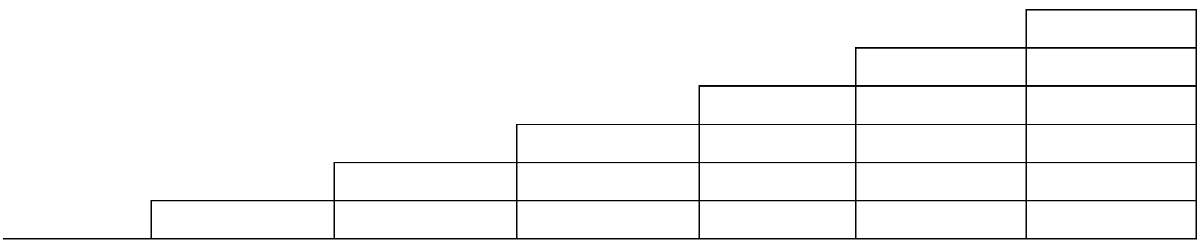
Having in mind these facts, in works [2-3] we tried to interpret the nature of these equations (11,a,b,c) as the equations having the meaning of solution, obtained from the solution of equation (10) for numerous dependencies on external force, where in the role of such force acts the relation of the type

$$\mathrm{v} = -\frac{e^2}{r}, \ldots \qquad (27)$$

Let us note, that continuing to achieve such goal, we paid attention to the following fact. While from equation of Schrodinger on the account of formula of type (27) there were obtained the numerous results, which have lead to the formation of ideas and results of modern theory of structure of matter, but the development of all such results was not completed in the full amount in the sense, that until present time we do not completely understand the true nature of equations (11,a,b,c). That is why we can not state with full confidence, that on the basis of possibility of results, obtained on this path, the problem of disclosure of true nature of vibrational and wave processes are solved completely.

Hence, taking into account all the above mentioned, we have the possibility to state, that the development of foundations of theoretical and empirical physics still remain in the state, when based on ideas and results, obtained in these fields, the true nature of α) vibrational and wave and natureof β) heat and diffusion processes is not disclosed. Hence, in our view, all these results can not serve as the foundation for achievement of correct answer to question (5) based on their analysis.

4. On the success of the analysis of fundamental ideas and equations of philosophy, mathematics, physics and possibility to obtain the answer to the question (5), i.e. disclosure of the true nature of solutions, which can be obtained during solution of Newton equations for many particles. As it was indicated in books [2-3], the fundamental ideas of scientific philosophy of Descartes, exhibited by him in works [4-6], can beunified with the help of scheme 1.



In the process of construction of this scheme we paid attention to the fact, that in these works Descartes there are ideas of the following content. According to Descartes, the fundamental ideas and results of all special branches of sciences can be unified in the following aspect, that this provides the possibility to make the correct choice of fundamental ideas and equations of sciences, which can be accepted in the role of

Of the foundation of the theory of cognition, β)

And this further provides the possibility to satisfactorily solve the problems, inherent to all other branches of sciences. Under this the ideas and results of these sciences will become sequentially complicated as far as the nature of objects becomes complex, which are accepted as fundamental of these branches of sciences.

Thus, Descartes supposed, that the days will arrive, when the golden fund of intellectual achievement of humankind will be ordered completely.

As is known, Decartus in the role of fundamental ideas accepted the ideas and solutions of algebra. Taking ideas and equations of algebra in the role of (28), he further solved the problems of geometry, thus obtaining fundamental ideas and equations of analytical geometry. On this path, as is known in works of Leibnic and Newton, there were obtained results, which can be accepted as fundamental ideas and equations of arithmetic geometry, algebraic kinematics and arithmetic kinematics and it was clarified, that in the role of (28) it is possible to use the equations of arithmetics along with the equations of algebra.

It is also widely known, that on this path there were obtained the fundamental differential equations of theoretical physics, i.e. dynamics of Newton (3) and dynamics of Hamilton (10) and based on these equations there were obtained the equations of the type (11) and (12) with the aim of disclosing the true nature of α) vibrational and wave processes and natureof β) heat and diffusion processes.

As was indicated above, until present time it was not possible to completely disclose the true nature of equations (11) and (12) and thus based on these possibilities it is hard to obtain the solution, based on which it would become easy to understand the true nature of phenomena of typeαandβ.

Under such state of affairs there are the foundations to suppose, that the reason is in the incorrect understanding of philosophical nature of fundamental ideas and equations of mathematics and physics. In order to convince ourselves it is important to pay attention to the following fact. Descartes as a philosopher was idealist. Therefore he from the ideas, which since the times of antics were developed on the basis of conceptions of:

Theory of inborn concepts (29)

and

Theory of acquired concepts (30)

for the truth accepted ideas inherent to (29).

Hence, taking as the foundation of the theory of cognition of ideas and equations of algebra, Descartes didn’t bother to clarify their true origin and nature. He was sure, that the fundamental ideas of this science are initially present in our brain since the time the absolute beginning – God created the human beings. Idealists were also Leibnic and Newton. Hence, when he used the ideas and equations of algebra and arithmetics in the role of foundations of the theory of cognition, he didn’t bother on the account of clarification of their true origin and nature. In the result it happened that foundations of whole mathematics and theoretical physics were further developed on the basis of idealistic understanding of the origin of algebra and arithmetics accepted as the theory of cognition.

On the other hand, as it was indicated above, modern state of mathematics and physics continues to remain unsatisfactory to a degree that in the process of obtaining their results they do not reflect the true nature of α) vibrational and wave processes and nature ofβ) heat and diffusion processes. In our view, after the utilization of scheme 1 we succeeded to unify all fundamental ideas of scientific philosophy of Descartes, which satisfactorily determine the path of truth, there is a possibility for joint analysis of ideas, inherent to this scheme with the results since the times of Descartes, Leibnic and Newton, obtained on the basis of mathematics and physics.

There is a foundation to suppose, that on such path, where during analysis of the nature of equations of mathematics and physics the role of ideas is taken into account developed in the field of scientific philosophy, now it is possible to clarify the true nature of results of algebra and arithmetic and their origin.

Under the joint analysis of ideas, taken into account in the course of construction of scheme 1 and results obtained based on theoretical physics, there were obtained results accounted with the help of scheme 2.

			$\dot{q}_i = \frac{\partial H}{\partial p_i}, \quad \dot{p}_i = -\frac{\partial H}{\partial q_i}$ (10)
		Algebraickinematics *Arithmetic* (33) *Kinematics*	$\frac{\partial S}{\partial t} + H\left(q_i, \frac{\partial S}{\partial q}, t\right) = 0$ (11,a)
	Algebraic geometry, (32) *Arithmetic geometry*		$H\left(q_i, \frac{\partial S}{\partial q}\right) = E$, (11,б) $\Delta\psi + \frac{8\pi^2 m}{\hbar^2}(E - V)\psi = 0$ (11,в)
Algebraic equations, *arithmetic*(31) *equations*			**?** (34)

And schemeIII

			$\dot{q}_i = \frac{\partial H}{\partial p_i}, \quad \dot{p}_i = -\frac{\partial H}{\partial q_i}$ (10)
		Algebraic kinematics *Arithmetic* (33) *Kinematics*	$\frac{\partial \rho}{\partial t} - [H\rho] = 0,$ (12,a)
	Algebraic geometry, (32) *Arithmetic geometry*		$[H\rho] = 0,$ (12,б) $\rho_i = \exp\frac{F - \varepsilon_i}{kT},$ (12,в) $\rho_{i,n} = \exp\frac{\Phi + \mu n - \varepsilon_i}{kT}$ (12,г)
Algebraic equations, arithmetic (31) equation			**?**(35)

Under the joint analysis of ideas, accounted with the help of scheme 1 and results, obtained in the field of empirical physics there were obtained results accounted in the course of construction of scheme 4

				Molecular sociology (40)
			Molecular psychology(39)	
		Molecular biology(38)		
	Theory of structure of matter (37)			
Probability theory(36)				

And schemeV

				Physical chemical sociology(44)
			Physical-chemical psychology(43)	
		Physical-chemical biology(42)		
	Physical chemistry(41)			
Probability theory(36)				

Hereinthecourseofconstructionof scheme 4 and scheme 5 the facts were accounted that the modern state of empirical physics, in which based on the possibilities of fundamental results obtained in the field of (37) and (41) which can in turn be obtained based on the solution of problems of a) many particles moving under the action of external force b) chaotically moving particles in the account of the fact, that the role of foundations of the theory of cognition in these fields can be accomplished by ideas and equations (36) is in satisfactory state.

In the course of construction of scheme 4 the fact was accounted, that the ideas and equations obtained in the field of (37) are successfully utilized in the course of obtaining ideas and results in the field (38), while on this path the ideas and equations of (37) and (38) are not successfully utilized for obtaining the results which can compose the content of (39) and (40)

In the course of construction of scheme 5 the fact was accounted, that ideas and equations of (41) are still not utilized both for obtaining the equations, which could constitute the content of (42) and development of foundations of (43) and (44). There is a possibility to fill these gaps, and for this generalizing the fundamental equations and results inherent to (37) and (41) for the case when the objects of research are such macroparticles as:

- High-molecular compounds, colloidal particles;
- Proteins, molecules, DNA, RNA;
- Particles of memory, which are synthesized in the brains of humans, when they acquire information;
- And also humans;

All this is considered in detail in books [2,3];

As was mentioned above, in the past physicists were very close to satisfactory development of the foundations of theoretical physics in such aspect, that on the basis of possibility of its equations, such as (11,a)-(11,c) and (12,a)- (12,d) it was possible to obtain such solutions implying the proof of fundamental equations (37) and (41), obtained with the accuracy inherent to empirical physics. But because of certain reasons they didn’t completely succeed in solving these problems.

As it was indicated in papers, published in books [2,3], new approach, whose basic peculiarity is the fact, that in the course of analysis of the nature of fundamental equations of theoretical physics the role of fundamental ideas of scientific philosophy of Decartus was accounted for allowing to overcome the difficulties facing the physicists. Based on new ideas it became possible to arrive to new understanding of the nature of fundamental equations of theoretical physics (11,a)-(11,c) and (12,a)-(12,d), in the result it became possible to obtain new solutions, with the help of which it became possible to fill in the gaps in the scheme 2 and scheme 3. The essence of new ideas, allowing to obtain such valuable results in general is reduced to the following:

1) It is supposed that the transition from Hamilton equation (10) to equations (11,a)-(11,c) and (12,a)- (12,d) is carried out by the role of multidimensional spaces with the dimensionality 3N+1, 3Nand 6N+1, 6N, whereN – is the number of particles.

2) Itissupposed, thatequations(11,a)-(11,c) and (12,a)- (12,d) obtained in such manner have the meaning of solution, obtained from the Hamilton equation (10) for:

α) for numerous orderly moving particles under the action of external force;

β) numerous chaotically moving particles.

3) Itissupposed, thatequations (11,a)-(11,c) and (12,a)-(12,d)obtainedinsuchway, which have the meaning for multidimensional spaces, as solutions have the accuracy inherent to algebraic physics. Solutionsofthetype

$$E_i = \alpha + k\beta_i, \quad \psi_i = \sum_{ir} C_{ir} x_r, \qquad (34)$$

(whereα – coulombintegral, β – resonanceintegral, C_{ir} – coefficients characterizing the share of participation of atomic orbitals in molecular orbital)

And of the type

$$a)\ n_A^0 = \frac{n^0}{\frac{1}{n_A}\exp\frac{\varphi - f}{kT} + 1}, \quad б)\ n_\phi^0 = \frac{n^0}{\frac{1}{n_\phi}\exp\frac{\varphi - f}{kT} - 1}, \qquad (35)$$

Obtained from such equations, have the meaning for the ordinary three-dimensional physical space and accuracy inherent for arithmetic physics.

It is supposed, that upon the filling of cells of scheme 3 and scheme 4 with the account of solutions (34), (35),ideas and results, based on which these schemes were composed acquire the final character.

4) In papers [7], published in [2] it is supposed that upon the transfer from equations of dynamics of Hamilton (10) to equations (11,a)-(11,c) and (12,a)- (12,d), the fundamental ideas of the theory of transformation will lead to the results, which can be understood as the results, obtained within the frames of possibilities of new variant

Of the method of separation of variables,

Whiletheideasusedinthecourseofobtaining (11,a)-(11,c) and (12,a)- (12,d) solutions of the type (34) and (35), are interpreted as ideas of new method, called

the method of separation of variables (46)

Really, if one pays attention to this, it is easy to note, that such unobservable variables as time t, coordinate q and impulse p upon the transfer to solutions (34) and (35) are removed step-wise. Intheresultofsolutionof(34) and (35) we obtain as expressions, which related the observable quantities.

As was mentioned in [8] in this respect on the basis of possibilities of these ideas and results, the ground forming ideas of which in their due time were proposed by founders of quantum mechanics, receive more accurate proof.

5) Also have the possibility to note, that these new results became possible, in order to obtain after the conclusion is made about the ideas, which since the time of antics are developed by founders of such directions as (29) and (30) the true are ideas (30). Consequently, this signifies that based on the ideas and equations of algebra there emerges the possibility of computations with the account of the nature of abstract values, while on the basis of possibilities and equations of arithmetics there appears the possibility to carry out the computations with the account of the number and nature of finite number of abstract sets.

There is a foundation that such new understanding of the nature of the ideas and equations of algebra and arithmetics are specifically materialistic. As is known, the idealist Plato thought that the fundamental concepts of mathermatics can be discovered, as they have the godly origin, then Aristotle thought that mathematical concepts can be created as the human brain from the birth is as white paper pure and the concept starts to appear only afterwards, upon the interaction of the child with the environment.

As we can see, based on new ideas and results the proof is acquired by the ideas of the theory of cognition, which originate from Aristotle, and in this respect it becomes possible to prove that he is more materialistic, than idealistic.

6) Let us note, that on the basis of possibilities of results (35), which were obtainedstrictly from the fundamental equations of statistical mechanics of Gibbs (12,a)-(12,d), after that the nature of these equations was understood as the solution inherent to algebraic physics, afterwards it becomes possible to obtain the interpretation of such constants, as the equilibrium constant (K) and adsorption constant (b), which within the frame of possibilities of equations (22,a) and (22,b), remain undiscovered.

Analogically, solutions of the type (34) also possess the possibility to disclose the physical meaning of formulae (16) and (17). Hence, keeping in mind these facts, we are in possession of the possibility to unify the ideas and results of scheme 2 and scheme 4 and also the schemes 3 and 5 obtaining the results accounted with the help of scheme 6.

						molecular sociology.
					Molecular psychology.	
				Molecular biology		
			Algebraic phys. Arithmetic phys.			
		Algebraic kinematics. Arithmetic kinematics.				
	Algebraic geometry. Arithmetic geometry.					
Algebraiceq.Arithmetic eq						

Andschemes 7

						Phys-chemsoc
					Phys-chem psych	
				phys-chembiol		
			Arithmetic phys algebraic physics			
		Algebra.kinem. Arithmetic kinem				
	Algebraic geom. arithgeom.					
Algebraic eq. arithmeq.						

In paper [9] published in book [2], it was shown that possibility of relations (22,a) and (22,b), obtained with the goal of description of experimental data is considerably widened after the nature of such constant as K and b is interpreted. Hence, keeping in mind these facts, we can conclude, that by drawing to order the results accounted in the course of composition of scheme 6 and scheme 7, the golden fund of intellectual achievements of humankind will be drawn to order approximately in the aspect dreamt by the genius Descartes.

8) It is reasonable to underline, that with obtaining new results, which became possible only after ideas and results were ordered, which became possible only after ideas and results were ordered accounted using scheme 2 and scheme 3

the deep meaning was disclosed of results composing the content of

$$\boxed{\textbf{Rational philosophy}} \qquad (47)$$

and

$$\boxed{\textbf{Empirical philosophy.}} \qquad (48)$$

Hence, there is a foundation to suppose, that after obtaining the results, accounted in the course of construction of scheme 6 and scheme 7 the problem was solved on the unification of fundamental ideas of (47) and (48).

9) Finally, it is possible to conclude, that with obtaining these new results the ideas were ordered and results, which can be accepted as the foundation of the theory of cognition

$$\boxed{\textbf{Foundation of the theory of cognition,}} \; 49)$$

As in the course of construction of scheme 6 and scheme 7 the fundamental branches of science were accounted with the philosophical nature of fundamental algebraic and arithmetic equations accounted in these schemes understood as completely, that on the basis of their possibility it is possible to explain the nature of

$$\boxed{\textbf{Cause-effect relations.}} \qquad (50)$$

Thus, having in mind all above mentioned, it is possible to state, that those new ideas, which were introduced for new understanding of the nature of fundamental equations of theoretical physics (11,a)-(11,c) and (12,a)- (12,d), and relations (34) and (35), which are the solutions of Hamilton equation (10) with the accuracy, inherent to algebraic physics and arithmetic physics, proved to be reasonable. Hence, we can say about the fact, that on the basis of possibility of new obtained results it became possible to obtain satisfactory answer to the question (5), i.e. to the question about which results should be accepted as analytical solutions, obtained from the solution of fundamental differential equations of theoretical physics of the type (1) and (10). Itturnsout, thatsuchsolutionsaretheequationsofthetype(11,a)-(11,c) and (12,a)-(12,d) as solutions, obtained with the accuracy inherent to algebraic physics and expression of the type (34) and (35) as solutions obtained with the accuracy inherent to arithmetic physics.

As was mentioned above in sections 2 and 3, in its due time mathematicians in the course of development of foundations of mathematical physics, and physicists in the course of development of foundations of theoretical and empirical physics due to the range of reasons deviated from the path of truth. Due to this they could not succeed to arrive to the solutions, based on possibility of which it would be possible to understand the nature of: α) vibrational and wave processes;β) heat and diffusion processes.

As we can see, based on new results it became possible to satisfactorily solve these problems. It turns out that for realization of vibrational and wave motion the system are able, which are composed of many particles, which move in an ordered fashion under the action of external force. According to conclusions of new results heat and diffusion processes have a place in systems, where numerous particles move completely freely and thus chaotically.

5. The possibility of new ideas for the disclosure of the nature of errors, which were made in the course of development of foundations of mathematical physics

5.1*On the nature of errors, made in the course of development of foundations of mathematical theory of vibration-wave processes.*

In the course of analysis, accounted using the scheme 3 shown in p.4 the following conclusions were made.

1) The fundamental ideas and equations of algebra and arithmetics, which in this scheme 2 are accounted and indicated by (31) form the foundation of the theory of cognition. Based on their possibilities it is possible to carry out the computations of

Abstract quantities (51)

With the account of their nature, and also

Abstract sets, the number of which can only be finite (52)

With the account of their nature.

It is further supposed, that the fundamental equations (32) and (33) were obtained in the course of solution of problems of geometry and kinematics, with the accuracy inherent to algebra and arithmetics with the account of the nature of

Geometric values and infinite number ofgeometric points, (53)

Kinematic values and infinite number ofkinematic points. (54)

2) Furthermore, in order to have the possibility to understand the nature of equations (11,a,b,c) as equations, having the meaning of solutions, obtained with the accuracy inherent to

Algebraic physics, (55)

The assumption was made, that upon the transition from Hamilton equations (10) to these equation, the role of multidimensional spaces was accounted for with the dimensionality 3N+1 and 3N. Hence, the nature of expression (34), which was obtained from the equation (11,c) with the account $\mathrm{v} = -\frac{e^2}{r},\ldots,$ was accepted as the solution of equation (10). This solution has the meaning for ordinary three-dimensional space and obtained with the accuracy inherent to

Arithmetic physics. (56)

3) In the course of obtaining these results the fact was taken into account, that upon the transition from equation (10) to equations (11,a,b,c) the possibility of utilization of the method of separation of variables looks rather different than usual.

After that in the course of obtaining the solutions (34) from these equations the possibility was used inherent to the method of reduction of variables.

As was shown in p.4, based on the analysis of these results, obtained in the field of theoretical physics, it becomes possible to satisfactorily understand, that vibrational and wave processes appear in the systems, where between material particles, the number of which is finite, there is an interaction.

Now compare these results with analogical equations, obtained in the field of mathematical physics (scheme-VIII):

			$\vec{F} = m\frac{d\vec{v}}{dt}$ (1)
		Algebraic equations of kinematics Arithmetic equations of kinematics	$\frac{\partial^2 u}{\partial t^2} - a^2\frac{\partial^2 u}{\partial x^2} = 0$ (6) .... $\frac{\partial^2 u}{\partial t^2} - a^2\Delta u = 0$ (7)
	Algebraic equations of geometry Arithmetic equations of geometry		$\frac{\partial^2 u}{\partial x^2} = 0$ $\Delta u = 0$
Algebraic equations Arithmetic equations			(6′) (7′) (7″)

In the course of solution of this part of the problem we will start from the assumption, that we have certain confidence in the fact, that with obtaining the results, accounted during construction of scheme 2 the development of foundations of physical theory of vibration-wave processes in principle part is satisfactorily completed. Hence keeping in mind this fact, we further based on the new ideas developed in the field of theoretical physics in the course of obtaining the results shown in scheme 2 have the possibility to newly understand the nature of equations accounted in the course of construction of scheme 8.

As was mentioned above in the course of transfer from equations of Hamilton (10) to equations (11,a,b,c) (scheme 2) the role was accounted of multidimensional spaces with dimensionality 3N+1 and 3N. This gives the possibility to accept them as the equation, having the meaning of solution with the accuracy inherent to algebraic physics. In due time mathematicians [10] upon the derivation of equation (6)and (7) from Newton equation (1) accepted as the foundation the possibility inherent to

Method of tangentials (57)

To curves described by vibrating strings.

Hence, having in mind this fact, now we have the possibility to suppose that upon the transfer from Newton equation (1) to equations (6) and (7) the role was used of infinite dimensional space. We have the possibility also to accept them as the equations, having the meaning of solution with the accuracy inherent to algebraic physics. Speaking of the nature of solutions (6′), (7′), (7″), we can note the following. Thesesolutionsfromtheequations(6) and (7) were obtained on the basis of possibility of separation of variables, under this starting from the ideas that $u(x,t)$ it is possible to imagine in the form $u(x,t) = T(t)X(x)\ldots$.

As we see, on this path in the course of obtaining these solutions with the accuracy inherent to arithmetic physics, it became impossible to remove such variables as t and x,y,z. This fact, in our view, further lead to penetration to the foundation of mathematics via incorrect path of such concept as actual infinity.

Thus talking about the mistakes, which were made in the course of derivation of equations (6), (7) and which further lead to the appearance of the concept of actual infinity through the solutions(6′), (7′), (7″) we note the following. Thefundamentalreasonofallthiswasthatequations (6) and (7), obtained from equations of dynamics (1), as equations having the meaning of solution not completely met the criteria of completeness of solution of physical problems.

According to the conclusions of the works [11], these equations corresponded to the criterion of completeness of solution of physical problems, if they were obtained from the solution of the equation (1) for N-physical particles for the case, when this number N is finite and if the peculiarity was accounted of interaction between the particles. But due to the fact, that upon the transition from equation (1) to equations (6) and (7) the possibilities were used of drawing tangential lines (but not the method of canonical transformations), there are the foundations to suppose that this problem was not solved correctly. They solved this problem for the case, when the studied objects were represented by infinite number of kinematic points.

5.2 On the nature of mistakes, made in the course of development of foundations of mathematical theory of heat and diffusion processes. As it is known, the fundamental equations of mathematical physics of parabolic type (8) and (9) shown in p.2, were obtained based on generalization of fundamental equations of mathematical theory of heat transfer

$$\begin{aligned} &a)\ \frac{\partial T}{\partial t} - \varphi\frac{\partial^2 T}{\partial x^2} = 0 \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ &б)\ \frac{\partial T}{\partial t} - \varphi\Delta T = 0 \end{aligned} \qquad (58)$$

diffusion

$$\begin{aligned} &a)\ \frac{\partial C}{\partial t} - D\frac{\partial^2 C}{\partial x^2} = 0 \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ &б)\ \frac{\partial C}{\partial t} - D\Delta C = 0 \end{aligned} \qquad (59)$$

where: T – is the temperature, C – concentration, φ and D – coefficients of heat transfer and diffusion.

As is known, for obtaining the derivation of equation (58,b) one starts from the assumption, that inside the body there exists the heat source, whose power is $Q(x,y,z,t)$. After that within the body there is separated a certain small volume ΔV

and for this the heat balance is constructed.Onestartsfromtheassumption, thatduringthetimeperiod dt there occurs the release of heat

$$\Delta Q = dt\int_{\Delta V} Q(x,y,z,t)dV .$$

After that, it is assumed that part of this heat

$$\Delta Q' = dt\int_{\Delta V} c\cdot\rho\cdot\frac{\partial T}{\partial t}dV .$$

goes to the increase of the temperature of the element ΔV, and the other part

$$\Delta Q'' = dt\oint_{\Delta S} q_u dS .$$

ofheattransferwillgototheenvironment. Equating ΔQ to the sum $\Delta Q'$ and $\Delta Q''$, the following is obtained

$$\int_{\Delta V} QdV = \int_{\Delta V} c\cdot\sigma\cdot\frac{\partial T}{\partial t}dV + \oint_{\Delta S} q_u dS ,$$

And also keeping in mind the possibility of theory of Ostrogradsky-Gauss

$$\oint_{\Delta V} q_u dS = \int_{\Delta V} \mathrm{div}\,\vec{q}dV \qquad (60)$$

The following is obtained

$$c\cdot\rho\cdot\frac{\partial T}{\partial t} - \mathrm{div}\,(k\cdot\mathrm{grad}\,T) = Q .$$

Furthermode, based on analysis of this equation the equation (58,б) is obtained. In this expressions $\vec{q} = -k\cdot\mathrm{grad}\,T$ – the vector of density of heat flux, c – specific heat capacity, σ – it density.

Let us note, in similar fashin based on the analysis of equations obtained from balance of concentrations the derivation of equation (59,b) is obtained.

In book [12] strict theoretical derivation of the main equation of Gibbs statistical mechanics was exposed as follows. As the probability of particle in region G related to phase points doesn’t change with time, then

$$\frac{d}{dt}\int_{G_{\text{т}}} \rho(X,t)dX = 0 .$$

Hence, applying the generalized theorem of Ostrogradsky, we obtain

$$\int_{G_{\text{т}}} \left[\frac{\partial\rho}{\partial t} + \sum_{k=1}^{6N}\frac{\partial}{\partial X_k}(\dot{X}_k,\rho)\right]dX = 0 .$$

As this integral is equal to zero for any region of integration $G_{\text{т}}$, then the integral expression should also be equal to zero

$$\frac{\partial\rho}{\partial t} + \sum_{k=1}^{6N}\frac{\partial}{\partial X_k}(\dot{X}_k,\rho) = 0 . \qquad (61)$$

Taking into account equation

$$\sum_{k=1}^{6N}\frac{\partial\dot{X}_k}{\partial X_k} = 0 .$$

And Hamilton equation (10), the second term of equation of continuity for phase density (61) can also be written in the following form

$$\sum_{k=1}^{6N}\frac{\partial}{\partial X_k}(\dot{X}_k,\rho)=\sum_{k=1}^{6N}\dot{X}_k\frac{\partial\rho}{\partial X_k}+\rho\sum_{k=1}^{6N}\frac{\partial\dot{X}_k}{\partial X_k}=\sum_{k=1}^{3N}\left(\dot{q}_k\frac{\partial\rho}{\partial q_k}+p_k\frac{\partial\rho}{\partial p_k}\right)=$$

$$=\sum_{k=1}^{3N}\left(\frac{\partial H}{\partial p_k}\frac{\partial\rho}{\partial q_k}+\frac{\partial H}{\partial q_k}\frac{\partial\rho}{\partial p_k}\right)=-[H\rho].$$

Hence, (61) isequivalenttoGibbsequation (10). It is easy to note, that theoretical derivation of Gibbs equation (1) is more rigorous than theoretical derivation of equations (58) and (59).

If in case of theoretical derivation of the Gibbs equation the possibilities of Ostrogradsky theorem are used in the course of derivation of equation (61) then in the case of derivation of equations (58) and (59) the possibilities of this theory are used in the course of derivation of equation (60) and also equation of the form

$$\oint_{\Delta V} C_n dS=\int_{\Delta V}\operatorname{div}\vec{C}dV,$$

where $\vec{q}=-k\cdot\operatorname{grad}T$ and $\vec{C}=-D\cdot\operatorname{grad}\mathrm{n}$ are the vectors of density of heat flux and flux of concentration coinciding in direction with the temperature gradient and concentration and equal by modulus to the heat amount

$$dQ=-k\frac{\partial T}{\partial n}dSdt \qquad (62)$$

And concentration

$$dC=-D\frac{\partial C}{\partial n}dSdt, \qquad (63)$$

Flowingduringthetime dt throughtheunitarea dS, located perpendicularly to the temperature gradient and concentration.

As it was indicated in p.4. upon the completion of development of foundations of statistical mechanics of Gibbs as the physical theory of heat conductance and diffusion of the results (24) and (25), and also (35,a), (35,b),as the proof for the main equations of empirical theory of heat conductance (18), (19) and diffusion (20), (21), (22),it became possible only after the renewed utilization of possibilities of the method of separation of variables and possibilities of the method of reduction of variables. Thus it was shown that the proof of such concept as concentration can be obtained if upon the transfer from Hamilton equations (10) to equations of the type (12,a)-(12,d)and (35) the variables will be reduced as time t and coordinates x,y,z.

Butafternoting, thatuponwritingtheexpressions(62) and (63), which were utilized in the course of derivation of equations (58) and (59), jointly with the concept of temperature –T and concentration –C the concepts were also used such as time and coordinates. Thus we think, that the derivation of equations (58) and (59) from the very beginning were obtained by false routes.

Now, in order to disclose the nature of the fact, that in its due time equations (58) and (59) were obtained on the false path, we pay attention to the following. In the course of construction of scheme 3 theoretical derivation of the Gibbs equation (12,a) is obtained based on equation of Hamilton dynamics (10). Thus in this meaning we can understand the nature of equation (12,a) as the equation having the meaning of solution obtained from solution of equation of Hamilton with the accuracy inherent to algebraic physics. But the same can be said about the nature of equations (58) and (59) and mainly due to the fact that at the foundation of the derivation of these equations there lies not the fundamental equation of theoretical physics (1) and (10) but the expression of the type (62) and (63) obtained with the possibilities of empirical physics and being internally contradictory.

In the course of construction of scheme 9, in order to underline this fact the part of scheme where the equations are located of the type (8) and (9) obtained as certain generalization of equations (58) and (59) is encircled by dotted lines

.

			$\vec{F} = m\frac{d\vec{\mathrm{v}}}{dt}$ (1)
		Algebraic equations of kinematics Arithmetic equations of kinematics	$\frac{\partial^2 u}{\partial t^2} - a^2 \frac{\partial^2 u}{\partial x^2} = 0$ (8) .... $\frac{\partial^2 u}{\partial t^2} - a^2 \Delta u = 0$ (9)
	Algebraic equations of geometry Arithmetic equations of geometry		$\frac{\partial^2 u}{\partial x^2} = 0$ $\Delta u = 0$
Algebraic equations Arithmetic equations			(8′) (9′) (9″)

This is made in order to underline the fact that these equations (8) and (9) are not the equations which were obtained based on possibilities of the fundamental equation of theoretical physics (10).

6. The possibility of new ideas for the disclosure of the nature of mistakes made in the course of development of foundations of theoretical and empirical physics.

6.1 *Why there is a necessity in disclosing the true nature of fundamental equations of matrix and wave mechanics.*

As is known, in the past it was understood that numerous facts obtained in the field of experiment can not be explained by simply operating over the fundamental equations of classical dynamics of Newton (1) and Hamilton (10). Also is known, that in such state of affairs Heizenberg proposed an idea of the following contents.He paid attention to the necessity of generalizing equations (10), which are obtained for the relation between unobservable values in such a way to obtain new equations connecting observable values. He supposed that based on new equations obtained for the connection of observable values it will become possible to explain the experimental data and escape from a difficult situation.

The fundamental equations of matrix mechanics have the form:

$$\left.\begin{array}{l} \dot{\boldsymbol{q}} = \dfrac{\partial \boldsymbol{H}(\boldsymbol{q},\boldsymbol{p})}{\partial \boldsymbol{p}}, \quad \dot{\boldsymbol{p}} = -\dfrac{\partial \boldsymbol{H}(\boldsymbol{q},\boldsymbol{p})}{\partial \boldsymbol{q}}, \\ \boldsymbol{pq} - \boldsymbol{qp} = \left(\dfrac{\hbar}{\iota}\right)\mathbf{1} \end{array}\right\} \qquad (64)$$

For the case, when the number of degrees of freedom is equal to one

$$\left.\begin{array}{l} \dot{\boldsymbol{q}}_{\boldsymbol{k}} = \dfrac{\partial \boldsymbol{H}}{\partial \boldsymbol{p}_{\boldsymbol{k}}}, \quad \dot{\boldsymbol{p}}_{\boldsymbol{k}} = -\dfrac{\partial \boldsymbol{H}}{\partial \boldsymbol{q}_{\boldsymbol{k}}}, \\ \boldsymbol{q}_{\boldsymbol{k}}\boldsymbol{q}_{\boldsymbol{s}} - \boldsymbol{q}_{\boldsymbol{s}}\boldsymbol{q}_{\boldsymbol{k}} = 0, \\ \boldsymbol{p}_{\boldsymbol{k}}\boldsymbol{p}_{\boldsymbol{s}} - \boldsymbol{p}_{\boldsymbol{s}}\boldsymbol{p}_{\boldsymbol{k}} = 0, \\ \boldsymbol{p}_{\boldsymbol{k}}\boldsymbol{q}_{\boldsymbol{s}} - \boldsymbol{q}_{\boldsymbol{s}}\boldsymbol{p}_{\boldsymbol{k}} = \dfrac{\hbar}{\iota}\delta_{\boldsymbol{is}}, \end{array}\right\} \qquad (65)$$

For the case when the number of degrees of freedom is arbitrary.
Here:***q*** – matrix of coordinates; ***p*** – matrix of the impulse.

It is widely, known that Schrodinger after the derivation of fundamental equation of wave mechanics (15) for the case, when the stationary systems are studied also obtained the equation of the form

$$i\hbar\frac{\partial\Psi}{\partial t} - H\Psi = 0 \qquad (66)$$

For the non-stationary case.

It is known, that based on the analysis of equation (15) jointly with expressions of the form (27) the results were obtained, which we can at present have as the foundation of the theory of structure of atom, molecules, solid bodies. But on the other hand it is widely known that in the course of solution of problems where the equation (64),(65) and (66) are taken as the foundation physicists faced the obstacles. If physicist for a long time developed the foundation of their science supposing that there is a correspondence between the fundamental equations of quantum dynamics written in the version of matrix and wave mechanics then Dirac in his book [14] came to conclusion that in reality this is not the case. Certainly, under such state of affairs there arises the problem of necessity of clarification of the true nature of both the equations of matrix mechanics (64), (65) and fundamental equations of wave mechanics (15) and (66).

6.2 *Based on fundamental ideas it becomes possible to correctly solve the problems whose solution target was to obtain new equations of matrix mechanics.* The essence of new ideas which allow to solve the problems of such content in general is reduced to the following:

1) We suppose, that among all of these results developed until present time in the field of scientific philosophy the more valuable are the ideas contained in the

works of Descartes [4-6]. It was these ideas, that we used to construct the scheme 1 as determining the path of truth.

2) Further, analyzing the ideas accounted during construction of scheme 1 and ideas and equations of Descartes, Leibnits, Newton obtained based on the equations of mathematics and physics it was first understood that gradually will develop the results accounted in the course of construction of scheme 2 and scheme 3.

3) It was further shown the possibility of generalization of fundamental ideas and equations obtained in the field of structure of matter and physical chemistry to lead to successful completion of the foundations of those programs which potentially contain the scheme 4 and scheme 5. It was understood that the fundamental equations obtained in the field of the theory of structure of matter and physical chemistry have the meaning of solution connecting the observable quantities.

4) The possibility was also shown of new interpretation of the nature of equations (11) and (12) accounted in the course of construction of scheme 2 and scheme 3 in such an aspect as to lead it to new understanding of the nature of expressions (16), (17) and (22).

It was understood that now accepting the nature of expressions (34) and (35) as the proof of results of type (16), (17) and (22) we can understand it as the solutions obtained from the equations of Hamilton for the interrelationship of observable quantities.

As is known, relations (16),(17) and (22) before obtaining their theoretical proof were widely used with the aim of description of experimental data. Hence after obtaining their theoretical proof with the disclosure of the physical meaning of the quantities such as equilibrium constant (K) and adsorption constant (b) there is a foundation to suppose that the possibilities for the description of experiment will be even deeper.

Thus, keeping in mind the above mentioned we get the possibility to make a following conclusion. Duringderivationofequations(11), (12) and (34), (35) from equations of Hamilton dynamics (10) as the equations having the meaning of solution with the accuracy inherent to algebraic physics and arithmetic physics, the problem posed by founders of matrix mechanics was resolved more correctly.

6.3 *On the contradictions, which are contained in the time-dependent Schrodinger equation.*As it was said previously in the course of construction of scheme 2 the following ideas were used as the foundations:

- algebraic and arithmetic equations were accepted as the foundation of the theory of cognition;
- fundamental equations of algebraic geometry and arithmetic geometry were accepted as the solution of the problems of geometry with the accuracy inherent to the algebra and arithmetics.
- the fundamental equations of algebraic kinematics and arithmetic kinematics were accepted for the solution of the problems of kinematics with the accuracy inherent to algebra and arithmetics;

- for thefundamental equations of algebraic physics, obtained from the solution of Hamilton equation (10) for many particles in external field equations (10,a,b,c) were obtained;

– equations (34) were accepted as the fundamental equations of arithmetic physics, obtained from the solution of the Hamilton equations (10) for many particles in external force field.

Based on possibilities of solution (34) it became possible to take into account not only the number of particles, which are influenced by links and move chaotically, but also the nature of these particles. Hence these results were accepted as solutions, which satisfy the criterion of completeness of solution of physical problems.

Let us note that to obtain to obtain such solutions from Hamilton equation (10) became possible only after the assumption was made, that equations (11, a,b,c) have the meaning for 3N+1, 3N-dimensional space, while (34) has the meaning of three dimensional space. In other words, during the transfer from initial equation (10) first to equations (11,a,b,c), and after that to (34) the possibility was used of both the method of separation of variables and method of reduction of variables.

Aswesee, Schrodingerequation(11,c) wasobtainedfrominitialequations (10) and (11,a) only in the course of reduction of variable t from further utilization and only under such assumption it became possible to introduce such functionals as the wave functionψ. But, as is known, Schrodinger after he obtained the equation (11,c), obtained also equation (66), which contains the time t variable, which was reduced earlier while deriving equation (11,c) from (10). Having in mind these facts, we think, that time-dependent Schrodinger equation (66) contains contradictions.

6.4 Possibility of new ideas for the development of the foundations of the many body theory. As it is known, talking about the fundamental results, composing the content of many-body quantum theory, one has in mind the ideas and results which were obtained from the solutions of the Schrodinger equation (12,c)and (66). At our time with certain amount of confidence it can be said, that we have a satisfactorily developed foundation of the quantum theory of many bodies (MBQT), when the results are meant, which are obtained in the course of solution of stationary Schrodinger equation (12,c), with the account of expression of the form (27). For instance, all results of the theory structure of matter are obtained based on this foundation. On the other hand, we still can not say with full confidence, that have similar successes regarding the part of MBQT where the fundamental results are tried to be obtained by joint solution of Schrodinger equation (66). Usually speaking about the results obtained in this part of MBQT in general there are ideas and results which were obtained in works [15,16] during development of the foundations of microscopic theory of superfluidity and superconductivity. As is known, the fundamental ideas of these works were accepted as satisfactorily developed theory of superfluidity and superconductivity. On the other hand, if one can trust to correctness of new ideas, which we proposed in works [17,18] then with confidence it can be said that this is not the case.

According to the contents of new ideas for the satisfactory development of the foundations of many body quantum theory equation (11,a)-(11,c) and (12,a)-(12,d), accounted with the help of the scheme 2 and 3 must at first be accepted as the fundamental equations of classical theory of many bodies, which are obtained from the solution of Hamilton equation (10) for many orderly and chaotically moving particles. After that the expressions of the form (34) and (35) must be accepted as the fundamental equations of quantum theory of many particles, which are obtained from the solution of the Hamilton equations (10) for many chaotically and disorderly moving particle. As we see, according to the essence of new ideas, we have the possibility to accept the stationary Schrodinger equation as the equation of classical theory of many particles. As was shown in p.6.3.on the basis of possibility of new ideas it becomes possible to arrive to the conclusion that the time-dependent Schrodinger equation (66) contains the contradictions. Certainly, if this is not the case, then appears the problem in the necessity of development on a new path of other microscopic theory of superfluidity and superconductivity.

As was shown in works [17,18] on the basis of new ideas such possibility does exist. In these papers we tried to show, that the nature of superfluidity can be understood based on interpretation of the nature of viscosity

$\mu$and nature of specific resistanceρin the formula $I = \dfrac{\Delta u}{\rho \frac{\ell}{S}}$ based on (35,b).

As was shown in [19], solving the Schrodinger equation (66) for many particles, one tries to develop the foundation of quantum theory of kinetics of chemical reactions. For instance, in this book there is contained the effort to show, how the equations of the absolute rates of reactions can be obtained by analysis of the solution, obtained from the solution of the equation (66). But in our view the effort to develop the foundation of quantum theory of kinetics of chemical reactions using such approach is based on the ideas containing the contradictions.

The essence of the contradiction is reduced to the following. As is known, usually the fundamental equations of the kinetics of chemical reactions are obtained by using the concept of the concentration of particles. This is the concept, which can be substantiated using the possibilities of the fundamental equations of Gibbs classical theory of many bodies. This approach from the beginning studies the system of many chaotically moving particles. Thus the effort to obtain the substantiation of the fundamental equations of the theory of kinetics of chemical reactions based on the possibility of equations of Schrodinger (66) contains in itself the contradictions.

Schordinger equations were obtained in an effort to solve the problem for many orderly moving particles in the external force field. Thus, it can not serve as the foundation in an effort to solve the problem where the concentration is the fundamental quantity.

7. The possibility of new ideas for the interpretation of the nature of the Navier-Stokes equation, and for derivation of the solutions explaining the nature of laminar and turbulent flows.

As was indicated in [20], if the Navier-Stokes equation in cylindrical coordinates can be applied to the description of the flow in circular tube Hagen-Poiseuille (fig 2) then one can obtain the equation

$$\mu\left(\frac{d^2u}{dy^2}+\frac{1}{y}\frac{du}{dy}\right)=\frac{dp}{dx}, \qquad (60)$$

Where the axis of tube is coincident with the axis x, radial coordinate y is measured from the axis of the tube. The terms of u in radial direction and direction tangential to the circle of dissection are equal to zero. Let the terms in axis direction to be equal to u; it depends only on the coordinates y. The pressure in each cross-section of the tube is constant.

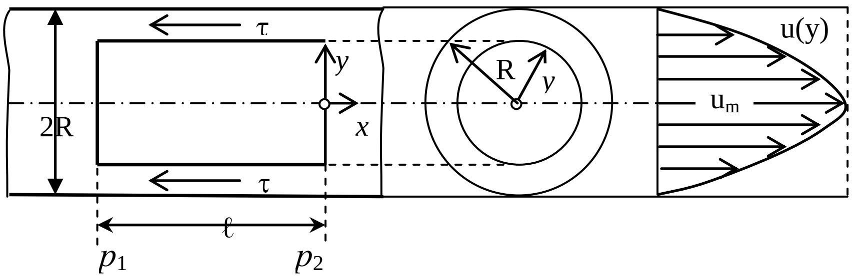


Fig.2. Laminar flow inside the tube

Solving this equation with the boundary conditions $u=0$ at all $y=R$ one can obtain the distribution of velocities along the cross-section of the tube

$$u(y)=-\frac{1}{4\mu}\left(\frac{dp}{dx}\right)(R^2-y^2), \qquad (68)$$

where

$$-\frac{dp}{dx}=\frac{p_1-p_2}{\ell}=const$$

Is the constant gradient of pressure, which is given.

We see, that the distribution of velocities within the cross-section has the form of paraboloid. Maximal rate of flow is indicated in the middle of flow of the tube and is equal

$$u_m=\frac{R^2}{4\mu}\cdot\left(-\frac{dp}{dx}\right). \qquad (69)$$

Average rate with the cross-section is determined by formula

$$\bar{u}=\frac{u_m}{2}=\frac{R^2}{8\mu}\cdot\left(-\frac{dp}{dx}\right).$$

Hence, though the cross-section there may flow per unit of time the amount of liquid

$$Q = \pi R^2 \overline{u} = \frac{\pi R^4}{8\mu} \cdot \left(-\frac{dp}{dx} \right).$$

This formula obtained as the solution of Navier-Stokes equation coinciding with the formula of Hagen-Poiseuille (4) shown in p.1., which was obtained based on the analysis of experimental data.

Let us note, that it is these results are meant, when speaking that on the basis of possibility of Navier-Stokes equation it becomes possible to understand the nature of processes, having place in laminar flow. Hence, based on this equation one tries to obtain the solution on the basis of possibility of which it would be possible to understand also the nature of processes occurring in turbulent flow. But, as is known the attainment of this goal is still unsuccessful. In our view, all these difficulties met on this path, when we try to obtain the solution from Navier-Stokes equation based on which it would be possible to understand the nature of turbulent flow is generally conditioned by our incorrect understanding of the nature of equations (2) and (3) and also the solution of the type (68) obtained from the equation (3). There is a ground to suppose, that we from Navier-Stokes equation try to obtain such a solution, which are not contained in this equation.

Usually speaking about the nature of Euler equation (2) and Navier-Stokes (3) equation one means [1], that they are obtained as a certain analog of Newton equations (1). But, the ideas, contained in this conclusion in reality do not provide the understanding of the true nature of equations (2) and (3). In our view there should have a place certain other ideas, based on which it would be possible to arrive to the disclosure of the true nature of these equations. Here we mean the ideas developed within [2,3] chasing the goal to provide a new interpretation of the nature of fundamental equations of theoretical and empirical physics. These new ideas are shortly exposed in p4 when we tried to obtain the answer to question (5) formulated in p.1. In p4. The answer to this question (5) was given in the course of ordering the idea and equation, which were systematized with the help of scheme 2 and 3. In the course of construction of these schemes new ideas and new equations of theoretical physics were systematized such that based on them it would be possible to arrive to understanding of the nature of vibrational-wave and heat, diffusion processes. We suppose, that upon the successful utilization of these new ideas it should become possible to understand not only the true nature of equations (2) and (3) but also the nature of solution (68) obtained from equation (3).

Scheme 10

			$\vec{F} = m\frac{d\vec{\text{v}}}{dt}$ (1)
		Alg. Equation of kinematics Arithmetic equation of kinematics	$\frac{\partial\vec{\text{v}}}{\partial t} + (\vec{\text{v}}\nabla)\vec{\text{v}} = -\frac{1}{\rho}\nabla p$ (2) $\frac{\partial\vec{\text{v}}}{\partial t} + (\vec{\text{v}}\nabla)\vec{\text{v}} = -\frac{1}{\rho}\nabla p + \eta\Delta\vec{\text{v}}$ (3)
	Algebraic equations of geometry Arithmetic equation of geometry		
Algebraic eq. Arithmetic eq.			$u(y) = -\frac{1}{4\mu}\left(\frac{dp}{dx}\right)(R^2 - y^2)$ (68)

is constructed such that fundamental ideas developed during construction of foundations of theoretical physics which accounted in the course of construction of schemes 2 and 3 could be utilized for interpretation of the nature of fundamental equations of theoretical hydrodynamics (2) and (3). Ideas, which were accepted as the foundation in the course of construction of schemes 2 and 3 are the following:

1) Algebraic and arithmetic equations were accepted as the foundation of the theory of cognition.
2) Fundamental equations of algebraic geometry and arithmetic geometry were accepted as the results obtained in the course of solution of the problems of geometry with accuracy inherent to the problems solved in algebra and arithmetics.
3) Fundamental equations of algebraic kinematics and arithmetic kinematics were accepted as the results obtained in the course of solution of the problems of kinematics with the accuracy inherent to the problems solved in algebra and arithmetics.
4) Fundamental equations of theoretical physics (11) and (12) and also expressions of the form (34) and (35) obtained from these equations, were accepted as the results obtained in algebra and arithmetics. That is equations (11), (12) and expressions (34) and (35) were accepted as the solution obtained from the solution of Hamilton equations, which now can be understood as fundamental equations of algebraic and arithmetic physics.

Now, taking as the foundation these ideas and results, obtained in the field of theoretical physics, we have the possibility to try to understand the nature of Euler (2) and Navier-Stokes (3) equation. Let us note, that in the course of construction of schemes 2 and 3 there appeared the necessity to make the assumption that in the course of transfer from Hamilton (10) equation to equations (11) and (12), there was used the possibility of multidimensional space with the dimensionality 3N+1,3Nand 6N+1,6Nand this gave the possibility to understand the nature of these equations having the meaning of solution obtained with the accuracy of algebra. We think that analogously, that we have the ability to newly interpret the nature of Euler (2) and Navier-Stokes (3) equations. For this let us supposed that upon the transfer from Newton equation (1) to equations 2 and 3 the assumption is made that in this case the possibility is also used of multidimensional space with dimensionality 3N+1 , where N is the number of particles.

But having in mind that this problem in general case is solved with the accuracy when the main objects of study are considered to be not only the number of particles of flowing liquid but also the number of infinite kinematic points determining the trajectory the rate of which in turn is determined by (68), then one can guess that the dimensionality of multidimensional space used in the course of transfer from equation (1) to equations (2) and (3) will be infinite dimensional.

We think, that in the course of such approach to understanding the nature of equations 2 and 3, their nature can be accepted as the equation having the meaning of solution obtained with the accuracy inherent to algebraic physics.

As was indicated in p.4, the expressions (34) and (35) have the meaning of solution obtained with the accuracy inherent to arithmetic physics, and have the meaning for ordinary three-dimensional space.

In p.4 it was indicated also, that during derivation of solutions from Hamilton equations (10) the possibility is used of the method of separation of variables and method of reduction of variables. In our view, these same ideas can be used for deep understanding of the solutions (68) and (69) obtained from Navier-Stokes equation (3). It becomes possible to comprehend that Euler equations (2) and Navier-Stokes equations (3) have the meaning of solutions obtained with the accuracy inherent to algebraic physics, and this has a place when the dimensionality of the space is supposed to be infinite. But the expression of the form (68) and (69) have the meaning of solutions obtained with the accuracy inherent to arithmetic physics and have the meaning for an ordinary three-dimensional space. In other words, here we want to say, that expressions (68) and (69) on the basis of abilities of new ideas obtain more deep interpretation as the solutions obtained from the solution of Newton equation (1).

The nature of solutions (68) and (69) can be understood more deeply if the trajectories of particles of liquid are considered as lines formed from the infinite number of kinematic points. Hence in this respect now it is possible to say that in the course of obtaining these solutions it becomes possible to prove, that laminar regime of fluidity has the place in ordinary case, when the particles of liquid move orderly such that the kinematic trajectory of its motion is the consequence of the infinite number of points, i.e. quants, influenced by continuity links.

Let us note, that in thoughts expressed above we trying to newly understand the nature of Euler equation (2) and Navier-Stokes equation (3) and also solutions (68) and (69) basically tried to make useful the ideas and equations of theoretical physics, which were accounted in the course of construction of scheme 2. During this it was possible to explain the nature of the processes, which have place in laminar regime.

Now to deepen these solutions with the aim of obtaining analytical solutions explaining the nature of turbulent fluidity let us try to make useful new ideas developed in the field of theoretical physics which were accounted in the course of construction of scheme 3.

As is known, the fundamental difference of Gibbs equation (12) used in the course of construction of scheme 3 from the main Hamilton-Jacobi-Schrodinger equation (11) accounted in the course of construction of scheme 2 in general is reduced to the following. If equation 11 is obtained from the equations of Hamilton dynamics (10) for the case, when the object of analysis was the system of many particles moving orderly under the influence of external force of the form $v = -\frac{e^2}{r}, \ldots$, then equation (12) is obtained from equation (10) for the case, when the object of analysis is the set of chaotically moving particles. It is widely known, that the most abundant variety of such motions is the chaotic motion conditioned by heat motion of the set of particles. Hence there is a ground for assuming, that while Navier and Stokes when moving from equation 2 to equation 3 accounted the role of $\mu\Delta V$, then they tried to account the role of this fact. In other words it is possible to suppose that Euler during obtaining equation 2 from equation 1 followed the goal of description of the behavior of such systems, which even at $T \to 0$, i.e. less than critical point continue to remain liquids. There are foundations to assume that in such systems we deal with the set of helium particles which under the action ∇p force move completely orderly, i.e. in a laminar flow. But in case when the temperature of the system becomes higher than critical there appear particles performing chaotic motion in three-dimensional space and due to this reason having velocities lower than the velocity of the main part of the liquid.

As is known, authors of the book [21] analyzing similar ideas tried to explain the difference between the superfluid liquid and ordinary liquid. But as the authors suppose for the substantiation of these ideas there should be solved the time-dependent Schrodinger equation (66) correctly writing the quantum hamiltonian with the acquisition of the possibility of the method of second quantization.

We also think, that for satisfactory completion of the solution of these problems it is important to interpret the nature of the constants of viscousity μ, entering the relation (4) with the help of (35,b). As was indicated in [17,18], this is possible only in case, when one starts from the assumption that viscosity constant μ, entering the relation of Hagen-Poiseuille (4) and specific resistance ρ, entering the formula of Ohm’s law are the quantities proportionally dependent on the concentration of excited atoms n_Φ^0 per unit volume. We assume, that the high the concentration in the system n_Φ^0 the higher the value of μ and ρ, i.e. assume that one can start from assumption $\mu \approx n_\Phi^0, \quad \rho \approx n_\Phi^0$.

Forthecomputation n_Φ^0, using the relation (35,б), we obtain

$$\mu = \frac{n^0}{\frac{1}{n_\Phi} \exp\frac{\varphi - f}{kT} - 1}, \tag{70}$$

$$\rho = \frac{n^0}{\frac{1}{n_\Phi}\exp\frac{\varphi - f}{kT} - 1}. \tag{71}$$

Furthermore, jointly considering the formulae(4), (70) and formulae of Ohm's law $I = \frac{\Delta u}{\rho \frac{\ell}{S}}$ and(71), we obtain

$$Q = \frac{\pi R^4 \Delta p}{8\ell \cdot \left[\frac{n^0}{\frac{1}{n_\Phi}\exp\frac{\varphi - f}{kT} - 1}\right]}, \tag{72}$$

и

$$I = \frac{\Delta u}{\rho \frac{\ell}{S}} = \frac{\Delta u}{8\ell \cdot \left[\frac{n^0}{\frac{1}{n_\Phi}\exp\frac{\varphi - f}{kT} - 1}\right] \cdot \frac{\ell}{S}}. \tag{73}$$

In our view, in these relations potentially are contained the ideas and results whose analysis can be used to satisfactorily understand the main difference between the phenomena of superfluidity and superconductivity and the phenomena of ordinary fluidity and ordinary conductivity. In other words, we think that for the transfer of the system from the state of ordinary fluidity and ordinary conductivity to the state of superfluidity and superconductivity the main role belongs to the concentration of phonons, as particles of heat determining the temperature of the system. In case, when we deal with temperature higher than critical, the concentration of phonons, as particles of heat is sufficiently high and all particles of both helium-4 and crystal lattice perform chaotic vibrational motion and this is exhibited in the form of resistance to fluidity and conductivity. If we deal with the critical temperature, then to this corresponds the state when due to very low concentration of phonons or their disappearance, concentration of helium particles or atoms of crystal lattice which do not perform the chaotic vibrational motion will be high. It is this process that leads to the disappearance of resistance exhibited in the form of viscosity $\mu$and specific resistanceρ. As a consequence the phenomenon is exhibited of superfluidity and superconductivity.

Speaking in other word, we think, that helium-4 which under low critical temperature has the properties of superfluidity is the ideal example of the theory of ideal Euler liquid. Hence, in this meaning superfluid liquid is the ideal example of liquid where all the conditions of laminar regime of flowing are satisfied. From the viewpoint of this conceptions at temperature higher than critical we deal with the system, where the share of liquid has the place, which flows in turbulent regime.

In our view, now taking as the foundation new ideas and results, it is easy to understand why until present time all the efforts to obtain the analytical solution from Navier-Stokes equation (3) on the basis of which it would be possible to understand the nature of turbulent fluidity were unsuccessful. The main reason of this is the following. In this equation in the role of the main factor using which the factor of non-ideality was accounted was the factor containing in itself the information about the nature of turbulent fluidity was accounted using the viscosity constants. Hence, in order to understand the nature of the processes occurring in turbulent regime it was necessary to utilize the solutions of the form (35,b), which are obtained from equation of Gibbs statistical mechanism for the interpretation of constantμ.But until that time trying to obtain the solution from equation 3 based on which it would be possible to understand the nature of turbulent fluidity, and this factor was overlooked.

Let us note, that in the above mentioned results the main difference of the phenomena of laminar and turbulent regime of fluidity we tried to explain on the example that the system where such processes occur was considered to be the superfluid liquid and ordinary liquid. While the main reason due to which the laminar flow transforms to turbulent flow of fluidity was considered to be the temperature factor. It was clarified, that the increase of temperature above critical the order inherent to laminar flow, i.e. superfluid regime is destroyed and as a result the system transfers to turbulent flow of fluidity. But in practice often one has to deal with systems where as the example of laminar flow of fluidity and turbulent regime of fluidity are considered the systems at high temperatures. In such cases usually as the example of laminar flow the case is considered, when the ordered motion of particles is observed with neglecting the fact that these particles are able to perform the chaotic vibration in three-dimensional space. Certainly, in such cases talking about the turbulent flow of fluidity we must keep in mind the decomposition of the ordered motion of liquid due to certain other reasons.

As is known, based on the analysis of experimental data it is clarified that the reasons due to which the ordered regime can be destroyed are in great amount. During this it is clarified that such factors affect the time when laminar regime of flow will get transformed into turbulent regime of flow. We understand, that the formulae of the form (71) and (72) can not be used for theoretical description of such processes. Nevertheless, there are grounds to supposes that these results have the value as the result based on which it became possible to understand the fundamental differences of processes, occurring in laminar and turbulent flow based on the possibilities of ideas and results of the foundations of theoretical physics.

Here we want to say that we succeeded in obtained results to understand the nature of processes occurring in laminar regime of flow assuming that there is a deep analogy between the fundamental equations of Hamilton-Jacobi-Schrodinger (11) obtained from equations of Hamilton (10) and equations of Euler and Navier-Stokes (2), (3) obtained from Newton equation (1). During this the facts were kept in mind that on the basis of fundamental equations obtained from equation (11) and equation (3), it became possible to understand that phenomenon conditioned by ordered motion of the set of particles appears in systems where the motion of these particles occurs under the influence of external force $\mathrm{v} = -\frac{e^2}{r},\ldots$ and Δp.We want to say, that in obtained results the nature of processes occurring in turbulent regime of flow was understood using the possibility of solutions of (35,b) obtained from the fundamental equations of Gibbs statistical mechanics.

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