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On the Possibility of Scientific Philosophy for Satisfactory Solution of the Problem of Interrelation of Classical and Quantum Physics

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ABSTRACT

As we know the main results of quantum physics in 1900 Planck began to obtain mainly because of the need to describe the experimental data. Therefore, it further became necessary to obtain theoretical justifications for these results. This means to obtain proofs of these results on the basis of the basic equations of theoretical physics, i.e. equations that are obtained on the way where the right choice of results is made performing the role of the basis of the theory of thought. As is known, these problems began to be solved, taking as a basis the possibilities of the following new ideas of Bohr. That quantum physics should be considered as a generalization of classical physics. But as we know, this path led to the results of matrix mechanics. Results for which such contradiction as non-commutativity of multiplication is inherent. In this paper for obtaining proofs for the results of Planck's quantum physics the fundamental ideas in the field of scientific philosophy were taken as a basis. That is philosophy where from the very beginning for the basis of the theory of thinking the possibilities of equations of algebra and arithmetic are accepted.

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§1. On Why Gibbs was Unable to Complete his Program to the End of Developing the Foundations of Statistical Mechanics

As it is known in due time Vant-Goff and Gibbs results on bringing in order the basic equations of technical thermodynamics

$$\begin{aligned} dU &= TdS - PdV, \\ dH &= TdS + VdP, \\ dF &= -SdT - PdV, \\ dG &= -SdT + VdP, \end{aligned} \quad (1).$$

came almost simultaneously. That is, the equations, which were obtained by taking into account the equilibrium condition

$$P = P' \; T = T' \quad (2).$$

However, as is well known Gibbs then generalized the basic equations of technical thermodynamics (1) while taking into account the equilibrium condition

$$\mu = \mu' \quad (3).$$

Thereby obtaining the basic equations of chemical thermodynamics

$$\begin{aligned} dU &= TdS - PdV + \sum \mu\, dn_i, \\ dH &= TdS + VdP + \sum \mu\, dn_i, \\ dF &= -SdT - PdV + \sum \mu\, dn_i, \\ dG &= -SdT + VdP + \sum \mu\, dn_i, \end{aligned} \quad (4).$$

Then he took into account the following fact that usually, taking as a basis the possibilities of the symbolic equation

$$n_A + n_B \leftrightarrow n_{AB} \rightarrow n_C + n_D \quad (5)$$

obtains the equation $K = \frac{n_C * n_D}{n_A * n_B}$ (6) $K = \frac{n_{AB}}{n_A * n_B}$ (7)

where K is the equilibrium constant. The constant on the basis of which it is supposed to take into account the nature of interacting objects. In these equations: n_A, n_B - concentration for many chaotically moving particles. At the same time he realized n_A, n_B - concentration of reactants of types A and B; n_{AB} - collision numbers; n_C, n_D - concentration of reaction products. Of course at this stage Gibbs had the intention of obtaining a justification for expression (6) and (7). Thereby he wanted to find out which of these results was more important for describing the experimental results. Then he realized that on the basis of the possibility of the basic equations of chemical thermodynamics such a goal could not be achieved.

As is well known, it was at this stage that he came to realize the following truth. That in order to achieve this goal there is a need to solve the basic equation of theoretical physics

$$\dot{q}_i = \frac{\partial H}{\partial p_i}, \quad \dot{p}_i = -\frac{\partial H}{\partial q_i} \quad (8)$$

for many chaotically moving particles. At the same time he realized that earlier at the solution (8) for many orderly moving particles it has already been solved and obtained Eq.

$$\text{a)} \frac{\partial s}{\partial t} + H\left(q_i, \frac{\partial s}{\partial q}, t\right) = 0$$
$$\text{б)}\ H\left(q_i, \frac{\partial s}{\partial q}\right) = E \qquad (9).$$

Therefore now by solving (8) for many chaotically moving particles we obtain the equations

$$\text{a)} \frac{\partial p}{\partial t} - [Hp] = 0$$
$$\text{в)} [Hp] = 0$$
$$\text{c)} \rho_i = exp\frac{F-\varepsilon_i}{kT}$$
$$\text{д)} \rho_{i,n} = exp\frac{\Omega+\mu n-\varepsilon_i}{kT} \qquad (10).$$

Thus at this stage he realized the following truths. That when taking as a basis the possibilities (10,c) and (10,e) he should obtain a justification for those equations which were previously obtained in the field of technical thermodynamics (1) and chemical thermodynamics (4). And also for expressions (6) and (7). Note Gibbs [1] taking as a basis the possibilities (10,c) and (10,e) actually managed to obtain the results

$$d\bar{\varepsilon} = -\theta d\bar{\eta} - \sum \bar{A}_1 da_1$$
$$d\bar{\psi} = \bar{\eta}\ d\theta - \sum \bar{A} a_1^{*} \qquad (11)$$

$$d\bar{\varepsilon} = -\theta d\bar{H} - \sum \bar{A}_1 da_1 + \sum \mu d\bar{v}_1$$
$$d\bar{\psi} = H d\theta - \sum \bar{A} da_1 + \sum \mu d\bar{v}_1 \qquad (12)$$

as a justification for (1) and (4). Then he realized that now there is a need to obtain justification for (6) and (7). And for this purpose, taking as a basis the possibility (10,e). Of course for this purpose, generalizing (10,e) while taking into account the possibility of the chemical equilibrium condition (3). However, as we know, Gibbs himself did not manage to obtain such a result. Note, if he had successfully completed this part of his program, then in this case he would have gotten the following new results which could be numbered as (13) and (14). Therefore, his main program on development of the foundations of statistical mechanics of non-ideal systems remained incomplete to the end.

§2. Why the Results Obtained by Planck in Quantum Physics also Turned Out to be Incomplete

As it is known in his time Planck's results in the field of quantum physics were obtained in the following sequence. First, when analyzing Maxwell's equation.

$$\nabla^2 \vec{E} - \frac{1}{c^2}\frac{\partial^2 \vec{E}}{\partial t^2} = 0,$$
$$\nabla^2 \vec{H} - \frac{1}{c^2}\frac{\partial^2 \vec{H}}{\partial t^2} = 0, \qquad (15)$$

realized that there was a correlation

$$\frac{8\pi\nu^2}{c^3} \qquad (16)$$

Then also as Rayleigh the nature of this relation began to understand as the number of standing waves in the frequency interval $(\nu, \nu+\Delta\nu)$. Further on this basis after multiplication (16) by the mean energy of the oscillator with natural frequency, one obtained

$$\rho_\nu = \frac{8\pi\nu^2}{c^3}\cdot\bar{u}. \qquad (17)$$

Then I was convinced that on this basis it is possible to describe the nature of only the long-wave region of radiation. Further, he set himself the task of obtaining a similar result on the basis of which it was possible to describe the nature, also of the short-wave part of radiation. The following fact became known that he solved the problems after he began to take such relations as a basis.

$$S = klnW, W = \frac{(N+P-1)!}{(N-1)!\,P!}, E = p\varepsilon, E = Nu \qquad (18)$$

Here (18,a) is Boltzmann's formula, P is some number, ε - quantum of energy, N - number of the oscillator. Thus he obtained

$$\bar{u} = \frac{\varepsilon}{\exp\frac{\varepsilon}{kT} - 1}, \qquad (19)$$

Then from (16) and (19) we obtain

$$\rho_\nu = \frac{8\pi\nu^2}{c^3}\cdot\frac{\varepsilon}{\exp\frac{\varepsilon}{kT} - 1}, \qquad (20)$$

Then it was found out that on the basis of this equation it is possible to describe the experimental results in full. As is known, after this Planck realized that now there is a necessity to obtain a rigorous theoretical proof for this equation (20). He is usually considered to have solved this part of the problem in the following way. He, taking as a basis the possibility (8,c) obtained as the equation of the canonical distribution function, obtained

$$\bar{u} = \frac{\sum_n E_n \exp\left(-\frac{\varepsilon_n}{kT}\right)}{\sum_n \exp\left(-\frac{\varepsilon_n}{kT}\right)} = \frac{\varepsilon}{\exp\frac{\varepsilon}{kT} - 1}. \qquad (21)$$

Then, when analyzing this result I came to the following conclusion. It turns out that the role of the notion of quantum of action is more fundamental than the notion of quantum of energy. As it is known application of the possibility of the concept of quantum of action further led to obtaining some very valuable results. For example, in 1913 N. Bohr could get the main results of his famous postulates only after that. Of course after that there came a moment when it was realized that there was now a need to obtain proofs for these results. For all these results were still the result obtained in the way, where the main role continued to fulfill the hypothesis about quanta. However, as we know, this was not the case. The main reason for this is the following. Bohr, who at this stage began to think hard about these problems, came to the following conclusion. that quantum physics should be seen as a generalization of classical physics. As we know, events then began to unfold as follows.

Heisenberg, under the influence of Bohr's new ideas, probably began to think like this. About why in his time Planck could not use the possibility of the basic equations of theoretical physics (7) and (8) to obtain his results. It looks like he realized the following truth. That Planck in his time failed to take advantage of such an opportunity. For on such a path arises the necessity of correctly interpreting the nature of these equations in the language of the number of degrees of freedom. However, he was unable to deal with such a problem. That is why he was forced at this stage to write the following thought

> «… всю проблему удалось упростить до такой степени, что вместо энергии излучения можно было взять энергию осциллятора, и таким образом, вместо запутанной системы, имеющей множество степеней свободы, возникла простая система с одной единственной степенью свободы».

(22)

Thereby he made a choice in favor of the idea that the idea inherent in the linear harmonic oscillator should be put in the main place. Probably for this reason Heisenberg now, in solving his problem, began to take as a basis the possibilities of the equation

$$\ddot{x} + \omega_0^2 x = 0 \qquad (23)$$

That is, the equation for a harmonic oscillator. He still thought that the possibility of this equation can be used as an equation of classical physics. Therefore he wrote

$$x(t) = \sum_{\alpha=-\infty}^{\infty} a_\alpha e^{i\alpha\omega t} \qquad (24)$$

And under the assumption that earlier the main results inherent in the first and second postulates were obtained as results with precision of quantum physics. Therefore further still wrote the expression

$$x(t) = \sum_{\alpha=-\infty}^{\infty} a_\alpha(n) e^{i\alpha\omega_n t} \qquad (25)$$

$$a(n, n-\alpha) e^{i\omega(n, n-\alpha)t} \qquad (26)$$

As is known further on this way, he obtained equations on the basis of which the peculiarities of the interrelation of the observed quantities were established. However, with accuracy up to the determination of the constant. Therefore, he further took advantage of the possibility of the relations

$$\int m\dot{x}dx = J = nh \qquad (27)$$

eliminated this flaw. Thus, he concluded that his main goal was achieved. As it is known further the basic equations of matrix mechanics were obtained

$$\left.\begin{aligned} &\dot{q}_k = \frac{\partial H}{\partial p_k}, \quad \dot{p}_k = -\frac{\partial H}{\partial q_k}, \\ &q_k q_s - q_s q_k = 0, \\ &p_k p_s - p_s p_k = 0, \\ &p_k q_s - q_s p_k = \frac{\hbar}{\iota}\delta_{is}, \end{aligned}\right\} \qquad (28)$$

Then the Schrödinger equation was obtained

$$i\hbar\frac{\partial\Psi}{\partial t} - H\Psi = 0. \qquad (29)$$

under the influence of the idea of matrix mechanics. As it is known after obtaining the basic equations of quantum mechanics (28) and (29), taking as a basis their possibilities the basic results of quantum electrodynamics were obtained. However, there are reasons to doubt that all results on this way were obtained on the way of truth. The evidence for this is the following facts. Dirac who is the founder of the available variant of quantum electrodynamics last thirty years of his life lived in search of the basic defect of this theory. He also intuitively realized that the main reason for all this is this. That the results of the available variant of quantum mechanics is also a doctrine with defects. Similarly, it makes sense to question the truth of the results obtained in the theory of superconductivity and superfluidity. Mainly because in their development it was necessary to use an assumption in the truth of which there is reason to doubt. That is, the assumption that at low temperatures in some metals there is an attraction between pairs of negative electrons. Therefore there is reason to suppose that a theory explaining the nature of all these phenomena must have been developed in a way in which the equations are taken as a basis

$$\begin{aligned} &\text{а) } \frac{\partial S}{\partial t} + H\left(q_i, \frac{\partial S}{\partial q}, t\right) = 0, \\ &\text{б) } H\left(q_i, \frac{\partial S}{\partial q}\right) = E, \\ &\text{в) } \Delta\psi + \frac{8\pi^2 m}{h^2}(E - V)\psi = 0, \end{aligned} \qquad (7')$$

$$\begin{aligned} &\text{а) } \frac{\partial\rho}{\partial t} - [H\rho] = 0, \\ &\text{б) } [H\rho] = 0, \\ &\text{в) } \rho_i = \exp\frac{F - \varepsilon_i}{kT}, \\ &\text{г) } \rho_{i,n} = \exp\frac{\Omega + \mu n - \varepsilon_i}{kT}, \end{aligned} \qquad (8)$$

However, only after their nature has been correctly interpreted. And also further results will be obtained on their basis

$$\begin{aligned} &E_i = \alpha + k\beta_i, \\ &\Psi_i = \sum_{ir} C_{ir} x_r, \end{aligned} \qquad (30)$$

$$n_A^0 = \frac{n^0}{\frac{1}{n_A}\exp\frac{\varphi - f}{kT} + 1}, \qquad (31)$$

$$n_\Phi^0 = \frac{n^0}{\frac{1}{n_\Phi}\exp\frac{\varphi - f}{kT} - 1}, \qquad (32)$$

And so that on this way it became possible to obtain a justification for the results of the first and second postulates of Bohr.

§3. On Why Gibbs Failed to Complete his Program, as well as the Reasons Why the Results Obtained in Matrix Mechanics Turned Out to be Inherent Contradictions for this Purpose Taking as a Basis the Possibilities of Scientific Philosophy

As it is written about it in paper [2] when taking as a basis the possibility of ideas considered with the help of scheme-1 further it is possible to come to the realization of the following truths. It turns out that since long ago in the basis of theoretical physics there were obtained results which can be taken into account with the help of scheme-2 and 3. On the other hand, in the field of probabilistic physics the results of which can be taken into account with the help of scheme-4 and 5 began to be obtained. Then it was realized that further the main goal should be the necessity to correctly interpret the philosophical nature of the results taken into account by means of scheme-2 and 3. And so that it would lead to obtaining results on the basis of which it would be possible to obtain justification for the results:

$$\text{a) } E = -\frac{me^4}{2\hbar^2}\cdot\frac{1}{n^2}, \quad \text{б) } 2\pi r = n\lambda; \qquad (33)$$

$$\text{a) } K = \frac{n_{AB}}{n_A \cdot n_B}, \quad \text{б) } \Theta = \frac{bn_A}{1+bn_A}. \qquad (34)$$

That is, the results that were previously obtained with the accuracy of probabilistic physics in the field of the theory of the structure of matter (33) and in the field of physical chemistry (34). Then it will be possible to combine the results accounted for by Scheme-2 and Scheme-4, as well as Scheme-3 and Scheme-5. Thus it will be possible to realize that there are results which can be taken into account by means of scheme-6 and scheme-7 given in paper [2]. On the other hand, all this means the following. It turns out that since long ago the main results in the field of theoretical physics have been obtained in the way, where for the

the basis of a theory of thought (35)

were adopted

algebraic equations, arithmetic equations (36).

Then we started solving problems

geometry, kinematics, physics (37).

And the results in the field of probabilistic physics began to get in the way where for (35) was taken the results of the

of probability theory (38).

Then began to solve problems for :
α) of many orderly moving particles
β) of many chaotically moving particles.

The results (7') and (8) turned out to be the results obtained by solving such problems with the accuracy of theoretical physics. The results (33) and (34) turned out to be the results obtained by solving such problems with the accuracy of probabilistic physics.

At this stage I would like to emphasize the following. For the correct interpretation philosophically of the nature of equation (7') and (8) the following ideas were taken into account. That in deriving (7') and (8) from (6) the roles of multidimensional spaces with dimensionality (3N+1) and (6N+1) have been taken into account. On the other hand still the following fact has been realized. That the nature of the numbers (3N+1) and (6N+1) can still be understood as

number of degrees of freedom (39).

Thus on this new way it was possible to eliminate the main difficulty that Planck had met in his time when obtaining his results. That is, when he wanted to take advantage of the possibility of equations (7') and (8) in solving his problems. However, because he then failed to cope with the difficulties associated with the need to use the number of degrees of freedom. Therefore, he was forced to use the ideas and results inherent in the linear harmonic oscillator. On a new way, after it was possible to interpret the nature of equations (7') and (8) as equations having sense in (3N+1) and (6N+1) dimensional spaces further it was possible to come to the results (30) and (31). And also it was possible to realize that on their basis it is actually possible to obtain a justification for (33) and (34). I also want to say the following. After all the above results had been obtained it was possible to realize the following. That all these results were obtained on the way when the problems were solved for substance-substance interactions (SSCI). For such problems turned out to be the most important and the simplest. After that now, taking as a basis the new ideas put forward at this stage, it was possible to solve also the problems of interaction of substances with radiation (VVSI) and interaction of substances with heat (VVST). These results are described in [3, 4]. That is why the most important and fundamental new ideas could be found out at the beginning when solving the problem on the interaction of substances with radiation (VVSV). Ideas that were accepted as fundamental for the formation of new true principles of canting. The essence of these ideas is basically reduced to the following

- There is a necessity to solve equation (6) for many orderly and chaotically moving particles on independent paths. Note however exactly the necessity to take advantage of such ideas was not realized for a long time.
- As it is known theoretical physics is a doctrine for which the main object of study is a multi-particle (energy quantum). Therefore, there is a necessity to optimally use the possibility of the idea of multidimensional space. This is in order to obtain results inherent to quantum physics on the basis of equation (7') and (8) obtained in the language of numbers of degrees of freedom. Exactly such step gives an opportunity to use correctly the possibility of the concept of the number of degrees of freedom.
- As it was revealed in the articles [5,6] after it was possible to optimally use the possibility of the concept of multidimensional space the following possibility appears. The basis of theoretical physics can be developed directly within the possibility of mathematical analysis. Up to now a lot of difficulties have arisen from the fact that long ago the interdependence between these sections of science was lost.
- On the new way of the nature of equations (7') and (8) it was possible to interpret as the basic equations of classical statistical mechanics inherent for the solution of problems of types α) and β). On the other hand, the natures of results (30) and (31), (32) could be interpreted as basic results inherent for quantum statistical mechanics of type α) and β). Therefore, taking as a basis the possibilities of these results one can conclude that at one time the main ideas inherent to the correspondence principle were put forward on a false path.

Note thus summarizing all of the above we can say the following. In obtaining results on this new way we widely used the opportunity of the fundamental ideas of Descartes' scientific philosophy. Especially those ideas, which are in his famous four rules. It was on their basis that it was possible to come to the realization that there are ideas which can be considered with the help of scheme-1. Then it was possible to realize that the ideas taken into account with the help of this scheme-1 to some extent correctly determines the path of truth along which the foundations of the scientific theory of cognition were further developed. Therefore, further it was possible to fill the content of this scheme.

Thus, we came to the realization that the results taken into account with the help of scheme-6 and 7 took place. Then, taking as a basis new results obtained on these paths it was possible to come to the following truths.

- As it is known in his time Gibbs could not complete in full his program on development of bases of statistical mechanics. Of course he himself was aware that this was indeed the case. For he was aware that he lacked some fundamental ideas for this purpose. On the new path, where the possibility of the basic ideas of scientific philosophy was taken as a basis, it was possible to fill in the gaps. For such ideas, which were not available to Gibbs at that time, were the following ideas. That is, those ideas about which it is written above (at the end of §3). These ideas appeared necessary for correct formation of quantization principles.
- The following facts are also known. In 1900 Planck first introducedhis idea of theenergy quantum when he wrote the relation (18) as $\varepsilon = h\nu$. That is why he further when obtaining the proof for the second multiplier, it had to be obtained by taking the possibility of a large canonical distribution. For it is this result that is the most general and deepest possible result of his statistical mechanics. As is known, however, he did not succeed in taking this step at that time. Therefore Planck was forced to obtain his main results assuming that there was no need to take into account the role of the nature of the cavity wall. Therefore, those results that he obtained in fact turned out to be incomplete. It is now clear why Planck was then unable to achieve this goal. It turns out that it was not due to the completeness of the very foundations of Gibbs' statistical mechanics.
- As it is known in his time Heisenberg, when he began to obtain his results. He took as a basis the possibilities of the equation for the harmonic oscillator. And he thought that it was an equation of classical physics. However, he did not realize at that time that this equation, which can be obtained jointly by considering Newton's equation for a single particle and the equation of the theory of elasticity, cannot be regarded as an equation of classical physics. For the fact that in obtaining this equation there appears such a quantity as frequency and indicates that this equation has the sense of a solution. At the same time, obtained by solving Newton's equation for many subordinate relations. It seems that further in the obtained results of Heisenberg began to appear such results as non-commutativity of multiplication, which is a consequence of this initial step, which contains a contradiction.

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