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L. I. Kordysch and the development the theoretical physics in the first half of the 20th century: All-European contexts

AT THE BEGINNING OF THE CENTURY universities in Kiev, Odessa, and Kharkov became the center of physics development in the Ukraine. There research programs along with physics teaching were carried out under the leadership of N.N. Schiller, A.P. Gruzincev, G.G. de Metch, I.I. Kosonogov's and others. Wide scientific contacts allowed close cooperation with famous European physicists and physical schools.

The formation and development of theoretical physics in the Ukraine were closely connected with the activity of the professor of st. Vladimir's Kiev University (further Kiev State University) and Kiev Polytechnic Institute, the director of the theoretical department of Scientific-Research Physics Institute, a Corresponding Member of the Vseukrainskaya Academy of Sciences, the member of French Physical Society, Leon Marian Iosivovich Kordysch, a Polish by origin. The sphere of his researches included works on the Theory of Relativity and Quantum theory, Physics of X-rays and Quantum Mechanics, the Theory of Fluctuations and its application in optics and radio engineering, the Theory of electro conductivity, photoelectric phenomena and radioactivity. By O. Hvolsona's response, «Kordysch was one of our most talented experts in theoretical physics». Unfortunately, the development of conceptual ideas of theoretical physics in Ukraine and their correlation with the all-European scientific process is poorly known in Europe. In the represented report this problems are surveyed in the context of L.I. Kordysch' life and scientific activity.

After graduating Kordysch was left for professor rank preparation at physical and mathematical faculty of st. Vladimir's Kiev University in 1900. At the same time he started working in Kiev Polytechnic Institute. In 1902 through the meditation of professor de Metch Kordysch was sent on business trip «to listen to Professor Planck's lectures on light electromagnetic theory» [12]. In further, as it was indicated in Curriculum Vitae, Kordysch himself undertook business trips to:

- Berlin University 1906 (M. Planck)
- Sorbonne 1911 (A. Puankare, Appel, Buti and Pell's laboratory)
- Munich University 1913 – 1914 (Zommerfeld, Cennek)

The collaboration with the famous scientists influenced Kordysch's scientific work direction.

After the first attendance of Berlin University the hand-written report on the business trip was saved. The report analyzed Planck's lectures. In particular, Kordysch wrote: «Planck's lectures are of interest from scientific world contemplation point of view. Planck, possibly judging from his printed works, adheres to empirical criticism direction» [12].

During the summer term Kordysch studied: «The experimental physics course» under the direction of prof. Varburg, and «The selection of radiation theory chapters» under the direction of prof. Krigar-Mentzel. Kordysch emphasized his interest to professor Planck's lectures on light electromagnetic theory and its application for some practical questions solutions. The light electromagnetic theory and light elasticity theory, optical phenomena in a crystal were examined in the lectures courses and color dispersion problem was stated as well. During the last task solution «only molecules resonator theory, in other words Maxwell's theory in remaking of Helmholtz, Drude, Lorentz and others» was described in details [12]. Although Kordysch pointed to the «lectures excessive formality» and deviation to mathematical supposition area.

It was not surprising that in the period from 1900 to 1910 the scientist developed the themes devoted to the problems of electromagnetic theory of light, theory of spectrums and vibration theory.

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Based on the archival documents [13] the following papers were published: «About the mechanism in spectrum» 1905, «About the spectral bands» 1906, «About single bands regularities» 1906, «About white light nature » 1908, «The dispersion of white light». In these works Kordysch supposed that the spectrum was caused by atoms of substance. In the paper of 1905 [1], he pointed that spectral properties study would help

«to state the presence of one substance or another. The new areas of researches promise to give us the opportunity to form ... the representation of nature and motions of atoms or their charges».

In this paper he accented that two conceptions existed, one of them was Aether light resilient theory according to which:

«not atoms or molecules oscillate, but electric charges on them or in them (Hertz) do; or it is possible to imagine an emitting particle as a body charged positively, surrounded by the certain number of negative electrons, like the sun by planets.»

During summer vacation in 1911 L.I. Kordysch was sent, by the faculty, to the naturalists' congress in Karlsruhe and Krakow. Apparently, at this time scientific contacts with Polish scientific public were established which in further became a reason for Leon Iosifovich's becoming a member of Krakow Academy of Sciences [the archive letter]. Unfortunately, we haven't had more detailed information of his collaboration with Polish scientific public so far, we don't have any information about his activity in Sorbonne either.

It is necessary to speak apart about the Munich business trip. There is an extract from the transaction of Kiev Polytechnic Institute Council of September 21th, 1913. This follows that, the petition for L.I. Kordysch's sending for a professor rank on physics preparation was directed to the Ministry. The Ministry declared that they

«can't send him to study physics, but they have no objection on his studying electro-technology».

The faculty changed the motivation. Therefore in future L. Kordysch was sent on business trip, from the Ministry of Trade and Industry, with the instructions written on 6 papers, with the postscript:

«it is obligatory to use the vacation time for studying telegraphic installations in Paris, Berlin, Nauen and Dancing».

As it is evident from the above-mentioned, the government was more interested in the applied aspect of the science. As the First World War broke out in 1914 the business trip lasted only one year.

This business trip was resulted in creating the thesis about Anomalous Zeeman effect as well as writing the course of electrotechnology. In the dissertation foreword was said that the experimental work was begun in Munich Physical Institute in Sommerfeld, however «the events of 1914 interrupted it and the work was not finished». The work consisted of two parts. In the first part the modern state of the problem (in that time) was put down. The second part was directly dedicated to Anomalous Zeeman effect theory study. There were general notions and equations theory; the question of electrons motion under the magnetic and electrical joint action; the anomalous effect for weak and strong fields and the comparison of theory with experiment. In his work Kordysch pointed that he didn't rely on a special atom model. «It is possible to be restricted to common representations for a considerable part of the atom like those which Rutherford used». The scientist using Bohr's quantization ideas (in 1915!), selected Lorentz's electron model for the description of electron conduction in atom. Because «Lorentz's electron' mass expression is consent with the relativity principle». In order to solve the set task, the scientist introduced a spatial arrangement of electrons orbits in atom. To similar outputs, usages of a spatial arrangement of orbits, came Weisenberg, Lande, Paili in one of the paper published in *Zeitschrift für Physik* later during 1922 and 1923

L.I. Kordysch's work main aim in his business trip was the development and importation new teaching methods in electrotechnology. However, besides that he independently studied different kinds of theoretical physics questions of modern science.

Let's stop at some papers, in which the main aspects of his activity are analyzed in the field of theoretical physics.

As an example, Einstein's relativity theory called vast discussion in the scientific world in that time. Kordysch's paper «Elementary derivation of the relativity theory basic formulas», where he actually adhered to A. Einstein's views, was published in 1911 [2]. There are basis to guess, that exactly this work was read by Abraham at the French physical society.

This work, as then L. Ya. Strum marked, one of the first which was written in Russian. Examining the questions of special relativity, L.I. Kordysch got Lorent's transformation by time determination as the observed physical factor. The paper starts with the formulation of «one main idea — the principle of relativity», which was given in this way

«Expression or formulation of the law, which a phenomenon follows, does not depend on the system of coordinates; the taken systems of coordinates may stay in a relative rest or relative motion» [2].

One more postulate of constancy velocity of light is added to this above — mentioned postulate. The author specified this postulate as superfluous because it «flows out as the consequence of the first one» and got the constancy of velocity of light in the empiric way. In the other words, L.I. Kordysch proved that the second postulate is the result of the first principle, the principle of relativity. The same derivation was introduced by M. Planck in his freshly published "Lectures on Theoretical Physics". And it was not surprising because as proceeding L.I. Kordysch was Planck follower. Similar outputs of the second postulate, besides the Plank, Kordysch, Ignatovskiy, Franck, Rose (Rothe) independently carried out.

In this paper, published in 1918 (*vague time*), he examined the competing theories of gravitation of such scientists as Mee, M. Abragam, Nordstrem and A. Einstein. L.I. Kordysch asked the question,

«Must physical laws save invariability of the formulation not only in regard to Lorent's transformation but also in the case of any formulas of transition from one system of coordinate to another, transformation of linear or not? Must the covariance be saved according to any transformations, when we pass from one system to another moving arbitrarily to the first one?» ([5], p. 7).

The author marked that Einstein kept to this position, introducing General relativity. Kordysch using the calculus of tensors made the derivation of gravitational field equation and studied the case of particle conduction in the Newtonian gravitational field. The information isolation of Russia and Ukraine in considered period did not promote wide scientific acquaintance in these countries with a General Relativity theory, which basis were explained in 1915. Even it now is considered, that the first works on a General Relativity theory in the former USSR appeared in 1922. On our view those works belonged to Kordysch's work came out in 1918. Therefore Kordysch's paper, where the General theory of relativity was stated and analysed, was one of the first.

Application of General relativity for explanation of the phenomenon of diffraction was the next step. One of the sequence of General relativity theory (the derivation of the beam of light in the gravitation field), was used for the explanation of diffraction. [5]. These works remained practically unnoticed because of the certain historical events.

After the appearance of the information about D. Miller's experiments in the 20s the discussion about the problems of existence of speeds exceeding the speed of light aroused. L.I. Kordysch published a short note. The paper «Electromagnetic waves with speeds more than the speed of light» (1924) was devoted to the analysis of electromagnetic fields equalizations. On the base of this equalization L.I. Kordysch considered the possibility of existence of electromagnetic waves which spread with speeds more than light speed but at the same time they submitted to Maxwell equalization. But L.I. Kordysch did not make a conclusion in relation to the fallaciousness of relativity.

In the paper «Relativity theory and theory of quantum» Kordysch's suppositions concerning the existence of gravitational intermolecular fields were expressed, and actually, the attempt was made to explain interatomic interaction. The scientist tried to spot the form of a geodesic curve for interatomic space (for the author « intermolecular space not appearing in finite stretches »). He explained it this way:

«first of all the metric relation of intermolecular spaces should be not Euclidean; secondary it is impossible to decide this problem without quantum mechanics».

«Hypothesis of quantum and Zeeman's effects» was a continuation of the given ideas development in the field of the theory of Zeeman Effect. Developing the ideas explained in the thesis, namely, the application of a quantum mechanics (for the author «a hypothesis of quantum») to the theory of electron moving, he gained thus a normal splitting triplet .

In the paper «To the theory of a gyroscopic molecule» the role «of gyroscopic properties of molecules for an explanation of some thermal appearances» was surveyed. As

«Since the atomic model of Rutherford became generally accepted, it is necessary to consider each atom and molecule, as a more or less composite gyroscope » (8, p. 112).

Thermal capacity with lowering of temperature: all features in the infrared absorption indicated bands by Rubens and Gettner's and not being part of Buerrium's theory, Einstein-de Haase's effect as well as appearance of para- and diamagnetisms took a simple explanation through Kordysch's theory.

In spite of the fact that the Kordysch' aspirants were known of physicists: Tartakovsky, Lashkarev, Bernshtein, Nasledov and the papers of the scientist and his activity were directed to establishing and developing conceptual ideas of the theoretical physics in Russia after revolution, his name practically is unknown, and his works are just finding their place in History of Physics establishing. Kordysch's works require the detailed historical and physical researches for the reconstruction of physics development complete situation, both in national and worldwide contexts.

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