

P N Lebedev’s “Factory of Young Physicists” and Saratov University

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Abstract. This review is about P N Lebedev’s scientific management methods and the role his students played in perfecting physics education and organizing scientific research at Saratov University.

Keywords: scientific school by P N Lebedev, Saratov University, history of physics in Russia

... Fruitful scientific activity is due not only to the personal engagement of the scientist, but also to the foundation of a school for training researchers.
P N Lebedev [1, p. 1184]

1. Introduction

The outstanding Russian scientist Petr Nikolaevich Lebedev forever remains in the history of world physics as a possessor of deep physical intuition and an unsurpassed experimentalist. He was ‘infected’ with physics when he was 12 years of age and organized all his further life so as to serve the physical sciences. He never experienced financial difficulties, but his way to recognition as a scientist turned out to be rather thorny, as he always undertook the most difficult problems. And he lived a very short life—he died at the age of 46 (the same as his father) having left after himself, apart from brilliant scientific work, a world-class scientific school in physics, the first in the history of Russia.

The biography of P N Lebedev is contained in the academic editions of his scientific writings [2–4], bibliography of publications [5], and scientific correspondence [6]. The most valuable sources of information about the personality of Petr Nikolaevich are also the recollections of his colleagues

from Moscow University [7] and of people involved in his scientific school [8–23], including recollections used in different biographic and jubilee materials (see, e.g., Refs [24–26]).

The present article is devoted to the methods of his work with students, the style of his scientific management, and the role of his scientific school in perfecting physical education and physical science at Saratov University.

2. Lebedev’s style of scientific management

P N Lebedev’s scientific school comprised senior students of the Faculty of Physics of Moscow University already in the first years of his work at the faculty (from 1891) after he defended his thesis for the degree of doctor of natural philosophy, “On the measurement of dielectric constants of vapors and the Clausius–Mossotti dielectric theory,” at Strasburg University on 22 July 1891.

On 6 October 1899, Petr Nikolaevich defended his doctor’s thesis, “Experimental study of ponderomotive wave effect on resonators,” at Moscow University. The reviewers at the defense were Professors Nikolai Alekseevich Umov and Aleksei Petrovich Sokolov. The uniqueness of his defense lay in the fact that Lebedev ‘ignored’ the defense of the ‘Russian’ master’s thesis forestalled by a set of complicated master’s exams. The scientific authority he acquired during the previous years played its role. According to the 1884 Charter of Russian Universities, the Council of Moscow University accepted Lebedev’s thesis defended at Strasburg University as a master’s thesis (foreign scientific degrees were not accepted in Russia at that time). During the whole history of pre-revolutionary Russian defenses, only 30 Russian scientists were honored with such a bestowal [27].

And in August of 1900, a triumph awaited Petr Nikolaevich at the Worldwide Physical Congress in Paris, where he gave a talk (on 11 August) on the experimental proof of light pressure on solids. This result placed him among the first (in scientific significance and craftsmanship of the work done) experimental physicists of the world.

The review of the activity of P N Lebedev as a scientific supervisor shows that he embraced (in the last years of his life with the participation of Petr Petrovich Lazarev) all the areas

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of research work done by his colleagues at the Physical Laboratory of Moscow University. It can also be said that the work carried out at Lebedev's laboratory was involved in the range of his scientific interests.

Having an uncomplicated and instructive experience of independent scientific research at the dawn of his scientific career at Strasburg University under the guidance of August Kundt and Friedrich Kohlrausch, Lebedev made the management of work at his laboratory fairly versatile. P N Lebedev's methods, such as high exactingness of the quality of scientific activities, financial support, complexity and harmony of research, adherence to the true experiment, and organization of creative discussions (at the 'formal' and 'nonformal' levels) and scientific seminars were unanimously adopted.

Seeing some improper practice or delay in work, Lebedev got harsh in his demands on students and expressed sincerely his hard-hitting judgment. Simultaneously, he was very tolerant. And he was even subjected to criticism from powerful disciples and partners (first of all P P Lazarev) for the extraordinary nurturing (in their opinion) of his students, which 'custody' consisted in the fact that Lebedev thought over the experiments in detail and prescribed every detail in the fulfillment of work (see, for instance, book [6, letter 206]), rendered direct assistance in overcoming difficulties and delays, corrected papers written by his students in the German language and wrote for them himself, held 'inspiring' psychological conversations, was indulgent and permissive to his students when they were taking master's exams, etc.

All this took a toll on his health, because it was additional physical and psychological stress. But perhaps Lebedev drove his students because he wished to do as much as possible, because he felt the burden of his serious heart trouble. The symptoms of the disease, when they manifested themselves, troubled him a lot. But as Lebedev got better, he became, according to his relatives, a witty, gay, fun-loving companion who gladly talked about his research. His interest in culture had been quite diverse since his young years; he loved the theater, music, and literature. When a young man, he was absorbed in mountain climbing and water trips (however, one of the trips was about to end tragically, because the physical strain provoked a mild cardiac arrest).

P N Lebedev's wisdom as a scientific teacher (precisely a teacher rather than a supervisor) can be thought to lie in the fact that, when aiming at preparing the young scientific generation for Russia, he behaved adequately to the situation. Disregarding some formalities whose absolute usefulness for science and education was improvable, he prepared personnel, and first of all 'taught' them to solve scientific, technical, and educational problems, which was and is of paramount importance for the country in any historical period of its evolution. And the assistance that took his time and strength paved the way for his students in the spheres of education and science, where they, as can be judged from the list of their names, showed their worth. Some of P N Lebedev's students can be seen in the group photo published in *UFN* [25, p. 563]. The P N Lebedev–P P Lazarev scientific school [13, 28, pp. 200, 201] graduated six academicians—P P Lazarev, S I Vavilov, N N Andreev, G A Gamburgtsev, P A Rebinder, V V Shuleikin; five corresponding members of the USSR Academy of Sciences—V K Arkad'ev, T P Kravets, S V Kravkov, A S Predvoditelev, N K Shchodro, full member of the Academy of Pedagogical Sciences of the RSFSR, A G Kalashnikov, doctors of science and professors

E V Bogoslovskii, V D Zernov, B V Il'in, N A Kaptsov, A R Kolli, P B Leiberg, V L Levshin, A B Mlodzeevskii, S N Rzhvekin, V I Romanov, N Ya Selyakov, A K Timiryazev, N E Uspenskii, E V Shpol'skii, P S Epshtein, K P Yakovlev, teachers and research workers V Ya Altberg, F K Kurepin, N P Neklepaev, K A Leont'ev, T K Molodyi, G B Port, V E Srebnitskii, S Ya Turlygin, N T Fedorov, and others.

The measure of talent and the degree of adherence to physics, erudition, diligence, and all other qualities necessary for research work were probably different in P N Lebedev's students. Some of them left a noticeable trace on the history of physics and founded their own scientific schools, while others worked fruitfully in universities in the country and abroad. But all of them came from P N Lebedev's school and were lucky to live and work closely with the bright prominent person who, as T P Kravets wrote, even outwardly "differed greatly from others: he was very tall, had great physical strength and an uncommonly handsome manly face" with a 'volcanic temper' and 'fire in his eyes' [14, p. 320].

3. P N Lebedev and Saratov University

One of the symbols of recognition of the outstanding role of P N Lebedev in the development of modern physics and strengthening the authority of Russian science is his monument erected in front of the building of the Faculty of Physics of Moscow State University. On the wall of the physical building of Saratov University is a memorial plaque with a portrait of one of Lebedev's first students—Vladimir Dmitrievich Zernov, the first head of the Chair of Physics of the university, the first dean of the Faculty of Physics and Mathematics, and later the rector of Saratov University opened in 1909.

When in the spring of 1909 Zernov defended his master's thesis (in the field of acoustics [29]) under the guidance of Lebedev, he was sent on Lebedev's recommendation to Saratov as an extraordinary professor. Introducing his candidature to the respected Russian physicist N N Shiller, who held a high position in the Ministry of People's Education of Russian Empire, at the end of his letter Petr Nikolaevich used the words "factory of young physicists" [6, p. 369]:

"During the last five years I set up here a factory of young physicists and would be very glad if in spring you called at our place on the way to the south to see how it all works: 18 people are now engaged in different problems, working on different waves, on the heat conductivity of vapors."

After finishing the gymnasium, the 19-year Vladimir Zernov did not hesitate in choosing where to continue his education—it was only Moscow University, because his predecessors, beginning with his great-grandfather, were 'universants', and 'not simple' ones: the grandfather Nikolai Efimovich, professor at the university, is considered to be the first doctor of mathematical sciences in Russia; his father Dmitrii Nikolaevich was professor of anatomy and rector. It was the opinion of his family that the younger Zernov should enter the Faculty of Physics and Mathematics and specialize in high-level mathematics. V D Zernov wrote in his memoirs that, as to physics, it was taught in gymnasium rather poorly: "the learning of physics was purely 'chalky', without a single experiment" [23, p. 55]. On the advice of academician Fedor Aleksandrovich Bredikhin, the outstanding astronomer, director of Pulkovo Observatory, professor at Moscow University from 1890 to 1895, Zernov 'went' to learn

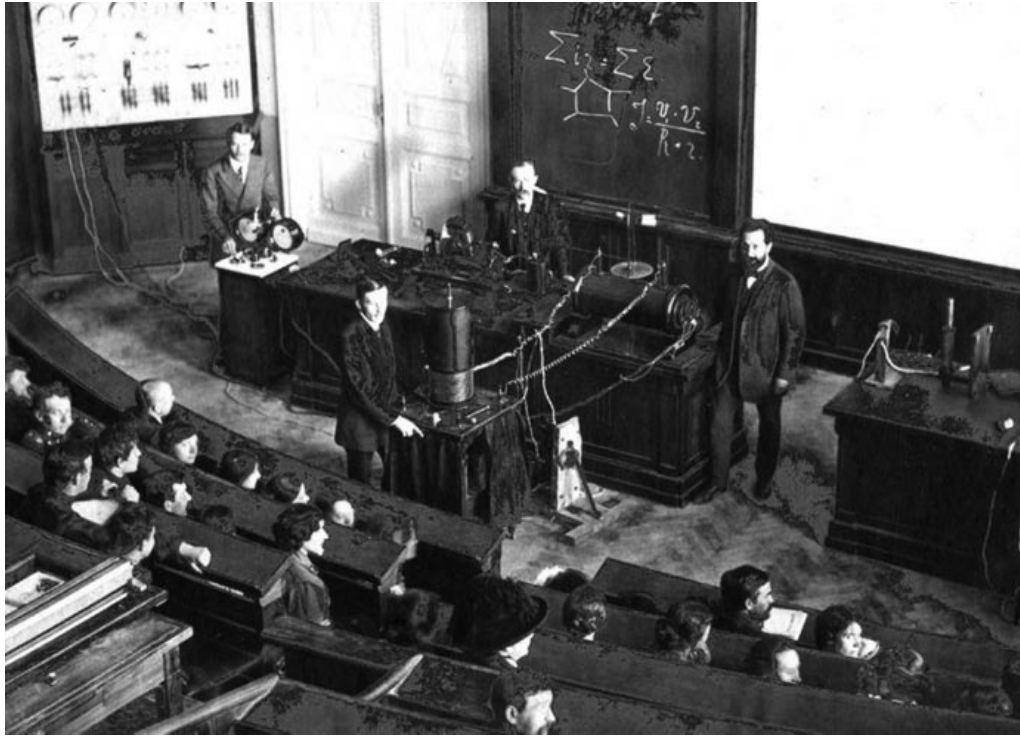


Photo 1. Lecture at the large physical lecture-hall of Saratov University (1914): on the right — V D Zernov, acting extraordinary professor; in the foreground near the Tesla transformer is assistant N P Neklepaev, at the blackboard is laboratory assistant V E Serebnitskii, and on the left is laboratory assistant I M Serebryakov.

physics. Once, Bredikhin asked D N Zernov what faculty his son had entered and added: “Advise your son to learn physics. There is a continual shortage of physicists, and with this occupation he will always earn his living” [23, p. 55]. V D Zernov did not ignore this advice, and when a second-year student, he already began purposefully attending a physical workshop where he got acquainted with Petr Nikolaevich Lebedev. And here is such a ‘coincidence’: F A Bredikhin’s classification of comet tails led P N Lebedev to the formulation of the theory of their formation under light pressure, which brought him his first great exposure to fame.

Naturally, the particular merit in the progress of Saratov University at the initial stage of its existence was due to its first rector — Vasilii Ivanovich Razumovskii. As concerns the physical direction, Zernov determined all the priorities very competently and successfully solved all the interrelated problems on the approval of the project, construction of the Physical Institute affiliated with Saratov University (project of L P Shishko and K L Mufke), the provision of laboratory equipment (in 1912, instruments were concentrated in a special collection; nowadays, part of them are in the Museum of Physical Instruments of the Faculty of Physics of SSU and are demonstrated at lectures) and educational literature (Zernov went to Petersburg to get the library of a prominent physicist and methodologist, corresponding member of Petersburg Academy of Sciences and later honorary member of the Russian Academy of Sciences, Orest Danilovich Khvolson), and on the invitation to Moscow physicists to come work. From the immediate circles of Petr Nikolaevich Lebedev and his closest student Petr Petrovich Lazarev came Konstantin Aleksandrovich Leont’ev, Nikolai Pavlovich Neklepaev, and Vladimir Efimovich Srebnitskii to work at

Saratov University. Neklepaev and Srebnitskii, just like Zernov, carried out scientific studies on acoustics under the guidance of P N Lebedev (Zernov and Srebnitskii were decorated with the V P Moshnin Scientific Prize in physics and chemistry, which was prestigious at the beginning of the last century and was ‘administered’ by the Society of Amateurs of Natural Sciences, Anthropology and Ethnography within Moscow University).

Organizing the first work at the physical practicum of Saratov University and experimental demonstrations at lectures fell to another research fellow of the Faculty of Physics of Moscow University, Ivan Maksimovich Serebryakov, former mechanic in the practicum of Professor A P Sokolov. All the above-mentioned people working in the faculty in the first years of its existence can be seen in a photograph taken in 1914 at a physics lecture in the large physical lecture-hall of Saratov University (Photo 1). Moreover, professor at Moscow University Sergei Anatol’evich Boguslavskii worked at the Chair of Physics of Saratov University from 1918 to 1921.

Here is how V D Zernov recalled the time of foundation of the Physical Institute in Saratov and P N Lebedev’s interest in it [21]:

“When I began working in Saratov, P N showed a lively interest in organization of the new Physical Institute and helped me in discussing the design of the building and its equipment. During my frequent visits to Moscow I first came to see P N and we discussed how and what should be purchased and constructed. I have a bound workbook given to me by P N during one of our first talks concerning the equipment of the new institute. The workbook was intended for fixing all the orders made for the physical laboratory at Saratov University. On the first sheet, P N made an inscription: “To Professor V D Zernov

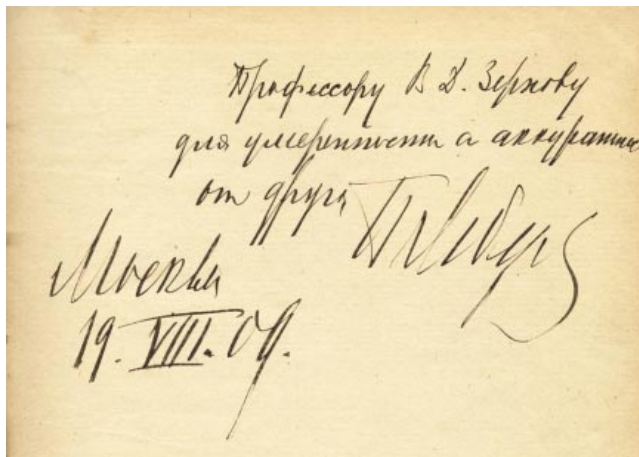


Photo 2. Complimentary made by P N Lebedev in the notebook (kept in the Museum of Physical Instruments of the Faculty of Physics of SSU).



Photo 3. Telegram from P N Lebedev sent on the opening day of Saratov University on 6 (19) December 1909 (kept in the Museum of Physical Instruments of the Faculty of Physics of SSU).

for moderateness and exactness from his friend—P Lebedev. Moscow. 19.VIII.09 (Photo 2).

On the next page, P N wrote the form to address a foreign firm. It is fairly typical that P N recommended that equipment for the physical laboratory begin precisely with this order—he did not accept the possibility of normal work of the physical laboratory without a well-equipped workshop. Later on, when organizing new laboratories, I many times had to prove this elementary truth to administration, and sometimes in vain!

The day of the official opening of Saratov University on 6 December 1909, I received a telegram from P N who heartily wished us success 'I greet the newly born Physical Institute. I hope it grows, is strong, and works successfully'" (Photo 3).

The saga of constructing and equipping the Physical Institute of Saratov University, the first steps of the new faculty, which today is one of the main faculties of the contemporary N G Chernyshevsky National Research Saratov State University, was described in detail in the paper by V D Zernov published in 1916 in the journal *Fizicheskoe Obozrenie* (Physical Review) of P A Zilov. The text was

reproduced in the jubilee (devoted to the centenary of the Physical Corps of SSU) issue of the 2014 journal *Izvestiya Saratovskogo Universiteta*. Novaya seriya. Ser. Phys. [30].

4. In place of a conclusion

The 'metropolitan trace' in the history of Saratov University can also be seen in one extraordinary event that happened in 1928 in the Physical Corps of SSU. This was one of the away sessions of the 6th All-Union Congress of physicists with international participation. Max Born spoke of this congress in sufficient detail in his paper [31] (the paper is accessible on the site of Springer Publishers). The organizer and president of the congress was academician A F Ioffe standing up for organization of physical research in large provincial towns. Vice presidents were P P Lazarev, P N Lebedev's closest colleague, and a disciple of P N Lebedev, Professor V I Romanov, while the secretary of the congress was P N Lebedev's disciple, docent and future academician and President of the USSR Academy of Sciences S I Vavilov. The school of P N Lebedev played a worthy role in the organization and conduction of the 6th All-Union Congress of Physicists, and the participation in the work of the congress of a number of well-known foreign physicists, including future Nobel Prize winners, was indicative of the growing prestige of Russian physics, which was largely due to the work of P N Lebedev and his disciples.

The interpreter at the Congress was Dmitrii Vladimirovich Zernov [32], a fourth-year student of Moscow University, the son of V D Zernov, a future corresponding member of the USSR Academy of Sciences and one of the heads of V A Kotelnikov Institute of Radio Engineering and Electronics of RAS—the institute still situated in the building of the Physical Laboratory of Petr Nikolaevich Lebedev, where he carried out his fundamental experiments on estimating light pressure.

The present day is the result of the past and itself determines the future. In the article "P N Lebedev's ideas concerning the origin of molecular forces" [33, 34], B V Deryagin who, as a child, was a member of the family of Petr Nikolaevich, evaluated the scientific contribution of Lebedev to this area and described the characteristic features of his personality:

"...The influence of P N Lebedev on his disciples acquired special power owing to the vehemence and intransigence in science typical of him. The statement of difficult problems is perhaps one of the main precepts of P N Lebedev. The influence of Lebedev's personality was undoubtedly transferred through his disciples, first and foremost P P Lazarev and S I Vavilov, and through their disciples and in one form or another is present in our science even now."

References

1. Lebedev P N *Phys. Usp.* **54** 1143 (2011); *Usp. Fiz. Nauk* **181** 1183 (2011)
2. Kravets T P, in Lebedev P N *Sobranie Sochinenii* (Collected Works) (Ser. "Classics of Science", Ed. and remarks by T P Kravets, N A Kaptsov, A A Eliseev) (Moscow: Izd. AN SSSR, 1963) p. 391; Kaptsov N A, in Lebedev P N *Sobranie Sochinenii* (Collected Works) (Ser. "Classics of Science", Ed. and remarks by T P Kravets, N A Kaptsov, A A Eliseev) (Moscow: Izd. AN SSSR, 1963) p. 406; <http://books.e-heritage.ru/book/10081289>
3. Lebedev P N *Izbrannye Sochineniya* (Selected Works) (Ed. and foreword by Prof. A K Timiryazev) (Moscow-Leningrad: Gostekhizdat, 1949)

4. Lebedev P N *Sobranie Sochinenii I. Nauchnye Raboty II. Populyarnye Stat'i i Rechi* (Collected Works I. Scientific Works. II. Popular Articles and Speeches) (Moscow: Mosk. Fiz. Obschch. im. P.N. Lebedeva, Tipo-litografiya Tovarishchestva I.N. Kushnereva i Ko, 1913); <http://books.e-heritage.ru/book/10070526>
5. Lukomskaya A M (Comp.), Shafranovskii K I (Ed.) *Petr Nikolaevich Lebedev: Bibliograficheskii Ukazatel'* (Petr Nikolaevich Lebedev: Bibliographic Index) (Moscow–Leningrad: Izd. AN SSSR, 1950)
6. Pogrebyskaya E I (Comp.), Fabrikant V A (Ed.-in-Chief) *Nauchnaya Perepiska P N Lebedeva* (Scientific Correspondence of P N Lebedev) (Ser. “The Scientific Legacy”, Vol. 15) (Moscow: Nauka, 1990); <http://www.arran.ru/?q = publicationguide = 42C5C81A-EDAA-1038-3BO7-940A455980B2>
7. Timiryazev K A *Nauka i Demokratiya* (Science and Democracy) (Moscow: Sotsekgiz, 1963)
8. Lazarev P P *Priroda* (4) (1912); *Priroda* (4) 63 (2010)
9. Lazarev P P *Priroda* (3) (1917); *Priroda* (4) 66 (2010)
10. Lazarev P P *Usp. Fiz. Nauk* 17 405 (1937)
11. Vavilov S I *Priroda* (5) 94 (1937)
12. Zernov V D *Uchen. Zap. MGU. Yubil. Ser. Fiz.* (52) 125 (1940)
13. Kaptsov N A *Uchen. Zap. MGU. Yubil. Ser. Fiz.* (52) 151 (1940)
14. Kravets T P *Usp. Fiz. Nauk* 46 306 (1952)
15. Timiryazev A K *Usp. Fiz. Nauk* 46 321 (1952)
16. Kaptsov N A *Usp. Fiz. Nauk* 46 325 (1952)
17. Lebedev P N *Usp. Fiz. Nauk* 46 329 (1952)
18. Lazarev P P *Sov. Phys. Usp.* 5 617 (1963); *Usp. Fiz. Nauk* 77 571 (1962)
19. Kaptsov N A *Sov. Phys. Usp.* 5 625 (1963); *Usp. Fiz. Nauk* 77 583 (1962)
20. Levshin V L *Sov. Phys. Usp.* 10 102 (1967); *Usp. Fiz. Nauk* 91 331 (1967)
21. Zernov V D *Vopr. Istorii Estestvozn. Tekh.* (4) 143 (2004)
22. “Pis'ma P N Lebedeva V D Zernovu” (“Letters of P N Lebedev to V D Zernov”) *Vopr. Istorii Estestvozn. Tekh.* (4) 149 (2004)
23. Zernov V D *Zapiski Russkogo Intelligenta* (Notes of Russian Intellectual) (Publ., introd. paper, comment. and indic. of names by V A Solomonov; Exec. Ed. A E Ivanov) (Moscow: Indrik, 2005)
24. Khramov Yu A *Sov. Phys. Usp.* 29 1127 (1986); *Usp. Fiz. Nauk* 150 585 (1986)
25. Ginzburg V L *Phys. Usp.* 52 530 (2009); *Usp. Fiz. Nauk* 179 562 (2009)
26. Ragulsky V V *Phys. Usp.* 54 293 (2011); *Usp. Fiz. Nauk* 181 307 (2011)
27. Krichevskii G G *Istoriya SSSR* (2) 141 (1985)
28. Shpol'skii É V *Sov. Phys. Usp.* 10 678 (1968); *Usp. Fiz. Nauk* 93 197 (1967)
29. Zernov V D *Usp. Fiz. Nauk* 1 121 (1918)
30. Zernov V D *Izv. Saratovskogo Univ. Nov. Ser. Ser. Fiz.* 14 (1) 59 (2014)
31. Born M “VI. Kongreß der Assoziation der russischen Physiker” *Naturwissenschaften* 16 741 (1928)
32. “On the 100th anniversary of the birthday of Dmitrii Vladimirovich Zernov (1907–1971)” *J. Commun. Technol. Electron.* 52 596 (2007); “K 100-letiyu so dnya rozhdeniya Dmitriya Vladimirovicha Zernova (1907–1971)” *Radiotekh. Elektron.* 52 637 (2007)
33. Deryagin B V *Sov. Phys. Usp.* 10 108 (1967); *Usp. Fiz. Nauk* 91 341 (1967)
34. Derjaguin B V, Abrikosova I I, Lifshitz E M *Phys. Usp.* 58 906 (2015); *Usp. Fiz. Nauk* 185 981 (2015); *Usp. Fiz. Nauk* 64 493 (1958)