Physics – Uspekhi **61** (1) 105 – 110 (2018)

FROM THE ARCHIVE

PACS numbers: 01.10.Fv, **01.60. + q**, **01.65. + g**, **01.75. + m**

THE 110th ANNIVERSARY OF THE BIRTH OF L D LANDAU

"Physics is supposed to be spoken of with a bit of irony": unknown speech by L D Landau, 8 April 1960

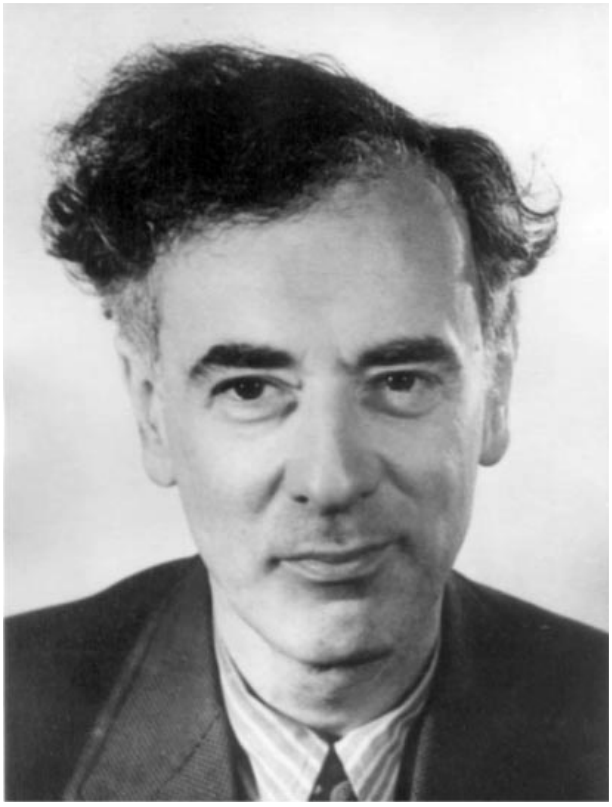
P A Druzhinin

DOI: https://doi.org/10.3367/UFNe.2017.10.038253

Abstract. A previously unknown speech by Lev Landau dated 8 April 1960 has been published, as transcribed from a unique tape recording obtained from the Russian State Phonogram Archive (Moscow). This is Landau's only true public speech known to have been recorded.

Keywords: Academician Lev Landau, history of physics, physics of the twentieth century, Nobel Laureates

From the Editor. The centennial anniversary of L D Landau's birth was widely celebrated in 2008. Thus, a session of the Physical Sciences Division of the Russian Academy of Sciences dedicated to Landau was held on precisely the 22nd of January 2008, and its contents were reported by *Physics–Uspekhi* [1–8]. The summer of 2008 saw a conference dedicated to Landau's jubilee (two reports at this conference were also published in *Physics–Uspekhi* [9, 10]. Dedicated to Landau's centenary was a paper in the *Herald* of the RAS [11] and almost an entire issue of the journal *Priroda* (*Nature*) [12]. Books and collections dedicated to Landau were published and reprinted (see, for instance, Refs [13–16]). It would seem that there are no and cannot be any unknown papers or speeches by Landau not described in the literature. All the more surprising is the finding made by P A Druzhinin: an unknown speech by Landau, the more so in the conservatory! The jubilees of outstanding physicists are usually celebrated in *Physics–Uspekhi* by strictly scientific publications, but in this case a decision was made, as an exception in the interests of the journal's readers, to publish this short article on the 110th anniversary of L D Landau's birth.



L D Landau
(22.01.1908–01.04.1968)

Foreword. The literature about the life and creative work of L D Landau is constantly increasing, and this branch of the history of science, which V L Ginzburg called 'landauknowing', may be rated among the actively developing ones. However, it develops largely for precisely the same reason why Vitaly Lazarevich gave it such a name: studying the twists and turns of the life of the scientist is becoming an increasingly fascinating story and not merely the pages of a scientific biography. This is supposedly the price paid to broaden the audience; however, it must be admitted that so remarkable a phenomenon of world science as L D Landau deserves a rigorous, impartial, and at the same time absorbing scientific biography, which has yet to be written. A brilliant example of an author capable of writing such a paper, we believe, was Viktor Yakovlevich Frenkel' (1930–1997), whose work fostered interest in the history of physics in many, including the author of this paper. It is to his blessed memory that we dedicate this paper.

Some time ago, in collecting material for our book *Ideology and philology*, we were working with materials from the Russian State Archive of Phonodocuments (RSAPD). Among other things, we ordered a tape reel with a recording, *Evenings of friendship between science and art*, which was held in the Big Hall of the Moscow Conservatory on 8 April 1960. The evening's host was V B Shklovsky (1893–1984), and it was precisely his name that aroused our initial interest in this

P A Druzhinin Institute of Linguistics, Russian Academy of Sciences, Bolshoi Kislovskii per. 1, str. 1, 125009 Moscow, Russian Federation
E-mail: petr@druzhinin.ru

Received 31 August 2017
Uspekhi Fizicheskikh Nauk **188** (1) 113 – 118 (2018)
DOI: https://doi.org/10.3367/UFNr.2017.10.038253
Translated by E N Ragozin; edited by L R Ryndina

Photo 1. I L Andronikov's speech at the 50th birthday of L D Landau (Moscow, Institute for Physical Problems, 22 January 1958). A photograph from the family archive of E Z Ryndina (Landau's niece), which was kindly made available for publication by her daughter L R Ryndina.

Photo 2. L D Landau's speech at his 50th birthday (Moscow, Institute for Physical Problems, 22 January 1958). This photograph from E Z Ryndina's archive was made available for publication by her daughter L R Ryndina.

recording (RSAPD, Inventory No. 6712). But, as witnessed by this magnetic tape, the main event of that evening was not Viktor Shklovsky and not even the philologian Irakly Andronikov [1] — a cult figure for the public, who also addressed the audience. The principal guest was academician Lev Davidovich Landau, whose appearance on the stage was met with a thunder of applause. Many will smile on learning about the site of his speech — the scientist, to put it mildly, was not a music lover.[2] However, on that day he visited the Moscow Conservatory with a different purpose: to tell the audience, which had little to do with physics or even absolutely ignorant about it, "what actually the science of physics is."

The meeting in the Big Hall of the Conservatory, which would have been termed 'smychka' (linking) in the pre-war years, was intended to emphasize the increased role of the natural sciences and, primarily, physics. V B Shklovsky's introduction, which commenced with the words "Some 50 years ago we were all nonscientists," did not hold the attention of the audience for long, and five minutes later Landau appeared on the stage. When introducing him, V B Shklovsky called him 'Lyandau', which is reflective of the now abandoned pronunciation common in the first half of the 20th century.

Although Landau spoke about physics, he was aware that his audience had little background in it; nevertheless, the scientist could easily hold the attention of the audience throughout his speech, which lasted, to be exact, for 23 minutes and 10 seconds. The text of this speech, which we transcribed from the tape recording, unfortunately cannot fully transmit the 'live' Landau voice of 8 April 1960: the reader will not sense the captivating tone and spirit of the outstanding scientist at the height of his scientific career.

His voice full of vitality, filled with passion and jocosity at the same time, as he spoke of the central subject of his life — theoretical physics. And his voice was not merely Landau's voice, but also the voice of the epoch of Khrushchev's 'ottepel' (thaw) — the brightest period of Lev Davidovich's life, when it seemed that all the hardships of the terrible years — his own as well as of his science and his country — had remained in the past.

That same month — on 23 April 1960, on Max Planck's birthday — it was announced that the German Physical society awarded L D Landau the Max Planck Gold Medal.

Only a short time later, on 7 January 1962, Lev Davidovich became a victim of a car accident and would never be the "former Landau", while his country, which had not had time to enjoy the ottepel', would become covered with ice again.

The written version of the speech published below is of paramount, exceptional interest. The point is not that this is an absolutely unknown text but that we are facing perhaps the only surviving speech of Landau the scientist made in front of an ordinary audience, a vivid and nontrivial speech. And the well-known fact that L D Landau quite sparingly committed his thoughts to paper, although he was fortunate to have remarkable co-authors for collaboration, makes this text unique. If it is recalled that any published text at that time — from a verbatim record to a paper or a monograph — was subject to editorial processing, revision, shortening, and, lastly, censorship, in our case this text is absolutely genuine, precisely the same as was pronounced on Friday evening, 8 April 1960.

We reproduce the speech completely. Since we had to make a written version of the sound record, we took the liberty of inserting punctuation marks and dividing the text into paragraphs, which is inevitable in transcribing oral speech to paper. Following punctuation rules and the character of L D Landau's style of speaking, we tried to make the written text and the vocal original as close as possible, which accounts for a somewhat peculiar placement

[1] Most likely it was Iraklii Andronikov, who had previously spoken at the meeting on the occasion of Landau's 50th birthday (see Fig. 1), who could persuade Landau to be his supporting speaker that evening in a place so queer for Landau. I L Andronikov's brother — Elevter Luarsabovich Andronikashvili — was a prominent experimental physicist, who was working in the Institute for Physical Problems and would closely communicate with Landau in those years (see Ref. [17]). (*Editor's comment*.)

[2] In the graphic vivid memoirs by Ella Zigelevna Ryndina (the daughter of Lev Landau's sister Sof'ya), there is an illustration of Landau's attitude to music: "when Dau visited us, mother would ask him to recite poetry.... He would declaim in a sing-song voice, loudly, somewhat monotonously, reveling in the music of verse. Interestingly, possessing such a sensation of verse and its rhythm, he did not like music at all. It just produced no impression on him. On hearing a violin, he would say: "When will my uncle finally finish sawing that box!" (see Refs [18–20]). All the more surprising is Landau's very appearance in precisely the Conservatory. (*Editor's comment*.)

of the punctuation marks. With our extremely careful handling of the text, we corrected without additional explanations the few cases of grammatical disagreement or slips of the tongue, which inevitably appear in a live speech.

Noteworthy also is the fact that the scientist laid tonal stress on some words, and so we italicized these words. And, lastly, since the audience followed L D Landau's speech by no means indifferently, we considered it necessary to introduce some parenthesized comments reflecting the state of the audience.

So: "I let Lev Davidovich Lyandau, I don't see him, have the floor." (*Applause*.)

L D Landau's speech

Thank you for your applause, but it seems to me that you are careless, because one should applaud at the end: what if I cast gloom over you, and you have applauded me in advance. I will later boast of it — groundlessly, as you understand. Well, I find myself in a tight corner, because it is not easy to decide what to say about physics that would be interesting to the public which gathered here. (*Laughter in the hall, applause*).

Usually, people ask you to tell them about the latest achievements in physics. Well, I could certainly do this, but only if I went crazy. Because physics is a consecutively developing science, and the latest achievements in physics are based on the penultimate ones. The penultimate ones rest upon pre-penultimate achievements, and so on. But I am afraid that those present in this hall know, at best, some twenty-fifth chain from the end. So, if I begin telling you about the last link, I would certainly bore you to sleep: no one would understand what we are dealing with. Well, and so I will not try to tell you about something specific in physics, which would be an exercise in futility, but will try to tell about physics, what actually the science of physics is.

Many might say: "of course! We know what physics is, we were taught physics at school, we were taught Archimedes' principle, which consisted of something; some of you remember this, but many, maybe, do not. (*Animation in the hall*.)

And so, the majority supposedly think that all physics is something like Archimedes' principle. In reality, modern physics is peculiar and quite different. I mean that modern physics is the result of a great amazement experienced by humankind, represented by physicists, when they got acquainted with the nature closer. Nature turned out to be entirely different from what people had thought of it. As short time ago as at the end of the nineteenth century people still thought that nature was something they saw every day. All people have taken baths, at least in their childhood. And so they know that there are, for instance, various liquids, which have specific properties, and, well, at least.... Everyone remembers that you feel lighter in a bath, and so every person has a certain idea of Archimedes' principle even if they do not remember it from physics.

Well, everyone knows that there are things in physics that are not seen directly in everyday life. Everyone has heard that there are atoms — tiny particles invisible to the unaided eye. But how does one think of an atom? You think of a large body and reduce it in your mind, until it turns into an atom. We cannot see the atom but can see a small ball. And so the atom is such a small ball to us. This is approximately what people thought at the end of the nineteenth century: that physics is based on that principle that physics is what we see in everyday life. But, of course, it is not. On the other examples we can see that it is rather special and that is what should be studied.

But it turned out that the reality is quite the contrary: nature is organized in a *completely different* way from what we see in our everyday life. It is based on entirely different principles. What occurs in nature is something completely beyond our imagination. And what is our imagination? Our imagination is something related to our life experience.

Why can we imagine liquids so well? Precisely because we have taken baths or bathed in the sea or seen liquids: we have come across liquids. And we cannot imagine things which we have not met and could never have come across whatsoever, because they lie fundamentally beyond our direct perception. And those things turned out to be quite different.

Therefore, the beginning of the twentieth century saw a complete revolution in physics. The first such revolution took place in 1905, coinciding in time with the great Russian Revolution of 1905, and is due to the so-called Theory of Relativity. Well, I think that many of those present have supposedly heard the term "Theory of Relativity," but far fewer of you perhaps know what this remarkable theory consists of, and it would certainly be very difficult if I tried to relate its real content.

What matters to me now is not the real content of the Theory of Relativity but that the Theory of Relativity, as they would say at one time, "contradicts common sense." It contradicts that sensation which a person has in his everyday life. We are accustomed to the existence of time. Time seems to flow so continuously and invariably that even philosophers, who wrote various works, have always believed that it is something that flows in nature by itself and so on and so forth.... But it turned out that this is not so at all, that time flows differently in different cases. That time flows quite differently for two observers who move relative to each other with a great velocity, a velocity close to that of light, with a velocity, say, above two hundred thousand kilometers per second. We cannot imagine this, because we cannot move at such a speed. Never in our lives have we done this, and if we tried to we would have immediately turned into vapor due to air resistance, much earlier than we would have reached this speed.

It is hard to imagine the storm caused in due time by the advent of the Theory of Relativity. Even contemporary physicists met it immensely unwillingly. To the extent that one remarkable physicist of that time — Planck — said that the way scientific verity takes to assert itself is unique. There is no way of convincing people who do not believe in it, and the following occurs: those who do not believe in the verity pass away, while young people are perfectly indifferent to it. (*Animation in the hall*.) And maybe this is the way the Theory of Relativity asserted itself. It is now explained in textbooks and nobody is excited about this matter. For us physicists, this is the Archimedes principle of a sort. This is something customary, scholastic, which is even improper to doubt.

But that was not the only revolution in physics. There also was a second revolution, maybe less powerful, because it was the second one, but maybe even more powerful in its content. This revolution is related to another remarkable physical theory, the so-called Quantum Theory. This revolution is remarkable in that it was very long. The principle of relativity was constructed at once by Albert Einstein, the physicist of greatest genius for many centuries, while the Quantum Theory was constructed for a very long time, about thirty years, beginning in nineteen hundred,

when it was first conceived, and ending in nineteen twenty seven, when that quantum mechanics which we now use became established.

And this long revolution led to findings which were even more terrible from the standpoint of common sense. But I will not set forth the Quantum Theory for you—this would be reckless of me—but will merely try, so to speak, to somewhat unsettle you by telling you maybe the most terrible thing inherent in the Quantum Theory. Consider some body, a very-very small one—and an electron, which the Quantum Theory is applied to, is something extremely small. And this small body is moving somewhere. How does a body move from the ordinary viewpoint? Now it is in one place, a second later in another place, in two seconds in a third place.... And the body moves so along some continuous curve. But the Quantum Theory suggests that the electron does move, but moves in quite a different way. It moves in such a way that it does not describe any curve whatsoever.

You may argue that this is nonsense: how can it be that a moving point does not lie in a curve? But it can be! Moreover, not only can it be so, but there exists a remarkable theory which makes it possible to predict all the events occurring to the electron in this case, and the theoretical predictions are amply borne out.

Therefore, in the course of development of their science, physicists had to abandon common sense, and for this they were rewarded with great successes. But the most remarkable one in this case is, it seems to me, the extraordinary triumph of the human mind. Physicists helped humanity to figure out things and matters which werecompletelybeyond their imagination. The human mind has triumphed over its own limitedness. This, of course, is the greatest triumph of science, the greatest triumph of human thought.

As I have told you, this all sounds absurd, but the absurdity is justified by the fact that this all entails remarkable inferences, which are perfectly confirmed by experiments. Furthermore, it turned out that these theories—the Theory of Relativity and Quantum Mechanics—embraced, when applied correctly, almost all surrounding phenomena. In this sense, physics has radically changed in comparison with what it was, say, fifty years ago.

Formerly, nature was something mysterious, incomprehensible; the main laws of nature were unknown. Physicists were probing separate phenomena, trying to sort them out.... Now, the picture has changed entirely and completely: we now know the main laws of the vast majority of phenomena. This, of course, does not mean that we understand these phenomena, at least not always. I can provide you an example: there is a wonderful physical effect, so-called superconductivity, which occurs in metals at very low temperatures. And so this effect was discovered in Holland in 1911. It is explained with the help of quantum mechanics, which was completed, as I have said, in 1927. But the theory which explains superconductivity, which explains why superconductivity arises from quantum mechanics, was invented only in 1958. An enormous distance, as you see. That is, knowing the basic laws by no means implies that we understand individual phenomena. And, of course, here there is still a vast field of activity.

For instance, there is biophysics, which has blossomed in recent years. None of us doubt that biological phenomena also obey the same quantum mechanics as do physical phenomena. However, only a pompous fool might think that this means that physicists can explain biological phenomena. Of course not! To understand how quantum mechanics can lead to biological phenomena calls for enormous work by biologists and biophysicists. This is a huge gap, which is yet to be bridged, this research still being in its infancy.

This is how matters stand with the application, so to say, of basic laws.

There is also another aspect of the matter—the laws themselves. I have already told you that we know some of these fundamental laws. But it would certainly be thoughtless to conclude that we also know everything in physics and that there is nothing left for us to do. This merely means that we now must try not only to explain phenomena, but to search for the phenomena that we do not understand. And nowadays they are no longer very hard to find. You often read in a newspaper that a huge new synchrotron has been constructed, which accelerates particles to ten billion volts, or about something similar. And when you ask: ''What is it for?''—the answer is that it is these devices which find unexplained phenomena. Previously, unexplained phenomena were lying around us—it was unnecessary to search for them. And to find unexplained phenomena nowadays, a complicated device has to be constructed and subtle experiments performed with it. This is precisely when unexplained phenomena emerge, which advance our science further and further ahead.

Well, I do not want to tire you, and so I do not want to delve into physics any more. I would like to tell you some more, this time not about physics, but about physicists: the majority of nonphysicists, and especially people unrelated to science, conceive science and scientists, physicists in particular, in precisely the wrong way. No matter how many books by our authors with physicist characters I may read or whether I see physicists on the stage, or more likely on the television rather than on the stage, for I have never had the courage to watch such plays (*animation in the hall*) with physicist characters. It is pertinent to note that these people are as similar to physicists as I am to the Chinese Emperor, who, in addition, does not exist now, as you know.

They are simply dissimilar in any sense. Well, to begin with, all scientists represented in fiction literature have, as a rule, a long beard. A nonbearded scientist character is a stunning exception in a novel, a rarity. It is partly clear why this happens. It traces to the nineteenth century; in the nineteenth century, beards were fashionable, and physicists of that time had beards. And, in general, it looks like novelists, so to say, borrowed the image of a scientist from the notions that existed many many decades ago. True, many have probably seen the portrait of (the now, unfortunately, late) Igor' Vasil'evich Kurchatov in the newspapers, and he was bearded indeed. In order that you do not conclude from this fact that physicists like to grow beards, I will tell you that he was nicknamed Boroda (the Beard) among physicists. When his friends spoke of him, they usually called him Boroda: ''Boroda said...,'' ''Boroda has done...,'' ''Boroda will go...,'' ''Boroda will do....'' This is precisely how it was spoken. Hence, it is clear that the beard was not a general attribute but precisely the attribute that singled him out. He was the sole beard-grower, and so since one could say ''Boroda,'' it was clear that it was Kurchatov and it was impossible to confuse him with anyone else.

Well, equally ridiculous is the solemnity always attributed to scientists in novels. They all speak in a high-flown and solemn language, and especially so about their science. The way they speak about science, in my view, reminds me of

nothing but the way priests can speak about religion. Frankly speaking, I have seen few priests, so that it may well be that even they do not speak about religion in this way, who knows? Well, physicists, of course, do not speak about physics in this way, anyhow.

Comrades, we all, physicists, are fond of physics, are so fond of it that we do not doubt everyone's fondness of physics. And therefore it will never occur to any of us to speak about physics in a solemn manner at all. We would take it as an insult. Physics is supposed to be spoken of with a bit of irony. This is merely a part of the style, to speak otherwise is inappropriate. If you speak in a solemn manner, you will be regarded as some fishy person: why do you speak so, what is it, have you conceived some cheat, are you going to wheedle something out of someone (*laughter in the hall*)? This is what comes to mind. Speaking in this way will not occur to any of us. One is not supposed to speak so!

In general, I should say that the style of present-day scientists is, of course, in marked contrast to the style which existed fifty years ago and is, of course, in no way reflected in the literature. Well, I should honestly say, although this may be a slight boast — and physicists are generally boasters, since all physicists are convinced that they are the salt of the earth and are important and the best, although they feign that they do not think so, but at heart they all think so, of course. And so I should say that, among people of different occupations that I have happed to meet, physicists, on average, are the most jovial (*Animation in the hall*.) This does not mean that there are no jovial people among people of other professions and that there are no bores among physicists, neither is correct. But on average the percentage of jovial people among physicists is higher, in my view, than among people of other professions. But I emphasize that this may be, so to say, a slight boast, I cannot deny this completely.

What I have told you applies to science in general. Now, in this connection I would like to tell you a few words also about physics. Physics is in a highly unique position. All sciences are, so to say, monogenetic. There is, say, a physiologist, and he is engaged in physiology. There is one type of a physiologist, but physiologists may deal with different fields of physiology, i.e., they are divided according to their fields. But physicists are additionally divided according to a specific principle, which is not encountered in any other science, namely: a physicist is either an experimenter or a theorist.

On hearing that one is a "theorist", the public usually thinks: this person is concerned with issues unrelated to practice. But this is a different aspect of the question, for both theorists and experimenters are concerned with scientific problems rather than with practical ones, because the classification takes place along these lines. Or sometimes people think that a theorist is engaged in reasoning, while an experimenter is engaged in experimenting. I should say that a man engaged in arguing is commonly referred to as a windbag rather than a theorist (*laughter in the hall*), which corresponds much better to his real nature, so to say. Theorists appeared in physics because physics became extraordinarily impregnated with mathematics. Because physics has so deeply delved into nature, the interrelation between natural phenomena and the laws of nature has come to be awfully complicated, and this interrelation may be understood and revealed only with the use of intricate mathematics. And so it turned out that one person is unable to simultaneously perform experiments, which is by no means an easy task, and have a good command of mathematics, which is not easy, either. And that is why physicists have divided into two different breeds of people, who do not, so to say, intersect with each other.

True, there was a relatively recent exception to this rule — the late Italian physicist, who lived his last years in America, Enrico Fermi. This outstanding person was both an experimenter and a theorist. But this is one of those exceptions that prove the rule.[3] Being such an extraordinary man Fermi could do what no one else was able to. If someone tried to follow Fermi's example, this would be the same as if I tried to become, say, a weight-lifter. The result would definitely be gloomy. The same is true for physics. Somebody without Fermi's genius would not be capable of it.

And so there are two different breeds in physics: they are different in everything, even in character. Experimenters and theorists differ in temper. Because an experimenter works in a laboratory, he must be rather diligent. A theorist works on his own account, with paper and a pen — previously used to work with a pencil, but now pencils have gone out of fashion — with paper and a pen.... And this is precisely the reason why they differ in temper and style. They treat each other with a touch of irony and a bit patronizing. That is why, for instance, an experimenter lets a theorist into his laboratory with caution, because the theorist might break some instrument; he should not be admitted just for the hell of it. As for the theorist, he laughs at the experimenter, and so on....

And this is the crucial co-existence of the two breeds that advances science. Science cannot be advanced by one of the breeds alone, because theorists cannot work without experiments: their theory would then lose touch with real life and turn into pure speculation devoid of any scientific value. And if an experimenter works without theory, he would merely perform useless experiments, which are numerous as it is and which, of course, do not advance science anywhere and are better not done at all.

Comrades, these are the brief remarks concerning physics which I wanted to make. I somehow have a feeling that the audience is getting a bit tired, and so I let you take a rest. All the best! (*Applause*.)

References

1. "Scientific session of the Physical Sciences Division of the Russian Academy of Sciences dedicated to the centenary of L D Landau's birth (22, 23 January 2008)" *Phys. Usp.* **51** 601 (2008); "Nauchnaya sessiya Otdeleniya fizicheskikh nauk Rossiiskoi akademii nauk, posvyashchennaya 100-letiyu so dnya rozhdeniya L D Landau (22, 23 yanvarya 2008 g.)" *Usp. Fiz. Nauk* **178** 631 (2008)

[3] Professor Roscoe White (Princeton University, USA), who read the paper in Russian, made an interesting observation in his letter to the member of the Editorial Board of *Physics–Uspekhi* I M Dremin. "...In the time of Shakespeare or even Dickens, the word 'prove' had a different meaning. It meant to test, to make difficulty. In Dickens you can find for example "My father proves me greatly", meaning that he gives him trouble. It did NOT mean 'support' or prove in the sense of proving a mathematical theorem. So the expression "The exception proves the rule" means that the exception is a test for the rule, a difficulty for it. It does not 'support' the rule. And of course the mis-interpretation that the exception supports the rule is just nonsense. An exception shows the rule to be wrong, it does not support it. This mistake is repeated by many English speakers, thinking that an exception to a rule helps sustain the rule! Pure logical nonsense.... It is just that the word 'prove' has evolved in English and does not mean what it did when this expression was written. But most English speakers understand it in its non logical form, using the present understanding of 'prove'...." It is our guess that Landau is being ironic, in line with the spirit of his speech, when saying that Fermi "is one of those exceptions that prove the rule." (*Translator's comment*.)

2. Andreev A F "L D Landau: 100th anniversary (Introductory talk)" *Phys. Usp.* **51** 601 (2008); "K 100-letiyu so dnya rozhdeniya L D Landau (vstupitel'noe slovo)" *Usp. Fiz. Nauk* **178** 631 (2008)
3. Kagan Yu M "Formation kinetics of the Bose condensate and long-range order" *Phys. Usp.* **51** 603 (2008); "Kinetika formirovaniya bose-kondensata i dal'nego poryadka" *Usp. Fiz. Nauk* **178** 633 (2008)
4. Pitaevskii L P "Superfluid Fermi liquid in a unitary regime" *Phys. Usp.* **51** 603 (2008); "Sverkhtekuchaya fermi-zhidkost' v unitarnom rezhime" *Usp. Fiz. Nauk* **178** 633 (2008)
5. Khalatnikov I M, Kamenshchik A Yu "Lev Landau and the problem of singularities in cosmology" *Phys. Usp.* **51** 609 (2008); "Lev Landau i problema singulyarnostei v kosmologii" *Usp. Fiz. Nauk* **178** 639 (2008)
6. Ioffe B L "Axial anomaly in quantum electro- and chromodynamics and the structure of the vacuum in quantum chromodynamics" *Phys. Usp.* **51** 616 (2008); "Aksial'naya anomaliya v kvantovoi elektro- i khromodinamike i struktura vakuuma v kvantovoi khromodinamike" *Usp. Fiz. Nauk* **178** 647 (2008)
7. Okun L B "The theory of relativity and the Pythagorean theorem" *Phys. Usp.* **51** 622 (2008); "Teoriya otnositel'nosti i teorema Pifagora" *Usp. Fiz. Nauk* **178** 653 (2008)
8. Lipatov L N "Bjorken and Regge asymptotics of scattering amplitudes in QCD and in supersymmetric gauge models" *Phys. Usp.* **51** 631 (2008); "B'erkenovskaya i redzhevskaya asimptotiki amplitud rasseyaniya v kvantovoi khromodinamike i supersimmetrichnykh kalibrovochnykh modelyakh" *Usp. Fiz. Nauk* **178** 663 (2008)
9. Pokrovsky V L "Landau and modern physics" *Phys. Usp.* **52** 1169 (2009); "Landau i sovremennaya fizika" *Usp. Fiz. Nauk* **179** 1237 (2009)
10. Ambegaokar V "The Landau school and the American Institute of Physics translation program" *Phys. Usp.* **51** 1287 (2008); "Sovremennaya programma shkoly Landau i Amerikanskogo instituta fiziki po perevodu nauchnoi literatury" *Usp. Fiz. Nauk* **178** 1359 (2008)
11. Pitaevskii L P "The great physicist" *Herald Russ. Acad. Sci.* **78** 75 (2008); "Velikii fizik" *Vest. Ross. Akad. Nauk* **78** 48 (2008)
12. "Spetsial'nyi vypusk. K 100-letiyu L'va Davidovicha Landau" ("Special issue. On the 100th anniversary of Lev Davidovich Landau's birth") *Priroda* (1) (2008)
13. *O Landau — Uchenom, Uchitele i Cheloveke: k 100-letiyu so Dnya Rozhdeniya* (About Landau — Scientist, Teacher, and Man) (Moscow: Torus Press, 2008)
14. Gorelik G E *Sovetskaya Zhizn' L'va Landau* (Soviet Life of Lev Landau) (Moscow: Vagrius, 2008)
15. Gorobets B S *Krug Landau. Zhizn' Geniya* (Landau Circle. The Life of a Genius) (Moscow: LKI, 2008)
16. Bessarab M *Lev Landau. Roman-Biografiya* (Lev Landau. A Biographic Novel) (Moscow: Oktopus, 2009)
17. Vernov S N, Kiknadze G I, Mamaladzev Yu G, Mamasakhlizo V I "Élevter Luarsabovich Andronikashvili (On his sixtieth birthday)" *Sov. Phys. Usp.* **14** 374 (1971); "Elevter Luarsabovich Andronikashvili (K shestidesyatiletiyu so dnya rozhdeniya)" *Usp. Fiz. Nauk* **104** 337 (1971)
18. Ryndina E Z *Sovetskaya Zhizn' L'va Landau Glazami Ochevidtsev* (Soviet Life of Lev Landau in the Eyes of Witnesses) (Comp. G E Gorelik, N A Shal'nikova) (Moscow: Vagrius, 2009) p. 183–309; http://berkovich-zametki.com/Avtory/Ryndina.htm
19. Ryndina E "Family lines sketched in the portrait of Lev Landau" *Phys. Today* **57** (2) 53–59 (2004)
20. Ryndina E Z "Vozvrashchenie k nachalu: o roditelyakh Dau i nemnogo o nem samom" ("Return to the origin: about Dau's parents and a little bit about him") *Priroda* (1) 39–45 (2008)