

Lev Davidovich Landau, Soviet Physicist and Nobel Laureate

On 1 April, Lev Davidovich Landau, Soviet Nobel Prize winner, died in Moscow at the age of 60. He had never fully recovered from injuries sustained in an automobile accident six years ago.

Landau was born on 22 January 1908 in the city of Baku on the Caspian Sea. At 14 he entered Baku University, and two years later transferred to the University of Leningrad, where at 19 he received his doctorate in 1927. This period marked the beginning of his scientific writings when, in 1927, he introduced the concept of the density matrix for energy. After spending two years at the Leningrad Physicotechnical Institute, where he worked on the theory of the magnetic electron and on quantum electrodynamics, he went abroad in 1929.

For a year and a half, he studied at the Institute for Theoretical Physics in Copenhagen, and also in Germany, England, and Switzerland. Through collaboration with the leading theoretical physicists of that time, Landau developed the wide scope of interest that characterized his career. His association with Niels Bohr was of particular importance in this development; Landau regarded himself as a pupil of Bohr. While still abroad, in 1930, he published his classic work on the diamagnetism of electrons in a metal (Landau diamagnetism), which later led to the explanation of magnetic susceptibilities of metals at low temperatures in strong magnetic fields (de Haas-van Alphen effect).

Shortly after his return to Leningrad, he went to the Ukrainian Physicotechnical Institute in Kharkov and headed the theoretical section from 1932 to 1937. During this period, in collaboration with Evgeny Lifshitz, Landau began the now famous series of monographs on theoretical physics.

In 1937, he was appointed head of the theoretical section of the Institute for Physical Problems in Moscow. He was jailed for a year in 1938 as a German spy and was released only after Peter Kapitsa protested personally to the Kremlin.

At the institute, his interest turned to the problem of superfluidity of liquid helium then being investigated experimentally by Kapitsa. Landau published his theory explaining the properties of helium II in 1941. As a consequence of his interpretation, Landau was able to predict the existence of the "second-sound" mode of wave propagation in helium II; second sound was observed experimentally in 1944. In the 1950s, he developed a general theory of the quantum Fermi liquid that predicted a number of phenomena in He^3 , among which was the existence of a "zero sound." For these investigations on condensed matter, Landau was awarded the Nobel Prize in 1962.

Landau was elected an active member of the Academy of Sciences of the USSR and had been awarded the Stalin Prize three times (once in 1941 for his theory of liquid helium and work on phase transitions). He was elected to membership in the Danish and Dutch Academies of Science, as a foreign member of the Royal Society of London and of the US National Academy of Sciences.

When Landau died, PHYSICS TODAY was preparing to publish the following two pieces about him. The first is a tribute by Academician Vitaly Ginzburg, written to celebrate Landau's 60th birthday, and the second is an interview with Landau. Both were submitted by the Novosti Press Agency.

Ginzburg, who has done research at the Physics Institute in Moscow since 1940, is professor of physics at Gorkii State University. In 1953, he became a corresponding member of the Soviet Academy of Sciences.

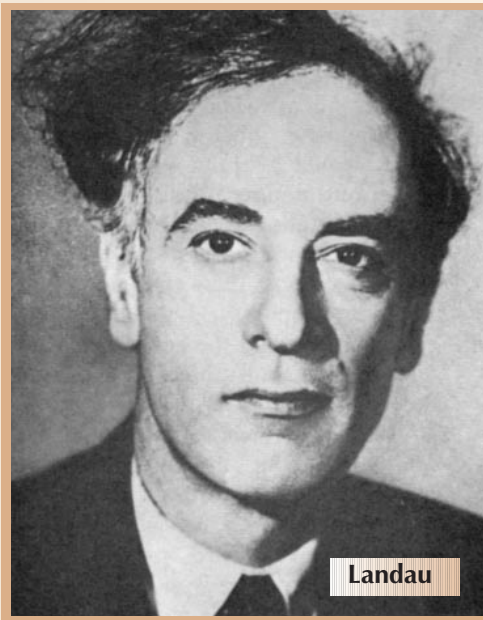
A Tribute by Vitaly Ginzburg

Landau's name is among the most famous physicists of our time. There are many reasons for this: scientific achievements in different fields of physics, popularity of his books (especially the many-volume course in theoretical physics produced jointly with Evgeny Lifshitz, which has been translated completely or partially into ten languages), a vivid personality, and an inimitable flair for polemics.

A most outstanding representative of theoretical physics as a profession, Academician Landau made an invaluable contribution to the formation and establishment of the style of modern theoretical physics.

Though a lot of things can be said about style and form in literature, the problem of style in science remains obscure and sometimes in complete darkness; compared to content, it plays a much smaller part in science than in art. If you take a book or a physics journal, however, with both publications 100 years old or even dating from the beginning of our century, you will easily see that the importance of style, particularly in science, is very great.

Sometimes such books and articles are almost impossible to read or very difficult to understand. The modern form of theoretical physics is distinguished by a characteristic laconism; only by operating expertly with the modern style, which found such a vivid and skilled expression in Landau's works and courses, can one remain the master of the situation through the whole of theoretical physics. You can engage today in the theory of superfluidity, tomorrow in quantum-field theory, and the day after tomorrow in the theory of metals. Landau is actually such a master of the situation, and he has helped his pupils to





Presentation of the Nobel Prize to Landau by the Swedish ambassador to the USSR (December 1962). Those present at the ceremony are (from left) Mrs Landau, Igor Tamm, Mstislav Keldysh, Nikolai Semenov, and Peter Kapitsa.

follow his lead.

Those who know Landau mainly from his books can assume that he is primarily an educator, an author of textbooks, a person who systematizes things already known but produces nothing new. Such a conclusion, however, would be quite wrong. Landau is an outstanding physicist, who is, at the same time, an educator by inclination. It is rare when one meets the combination of these two aspects in a single personality. I think that actually here we find the key to the assessment of Landau's place in theoretical physics.

Landau's occasional abruptness has brought about misconceptions that have become a part (and a rather distorted part) of a legend. I, for instance, have heard people saying, "Landau thinks he is more clever than anyone else." This is completely erroneous, however, and there are many chances for one to see how soberly and modestly Landau assesses his place in science. Many years ago, his love for systematization and clarity led him to classify physicists, by way of a joke, according to the scale of a slide rule. This means that a physicist of second-class standing has achieved ten times less than a physicist of the first class. According to this scale, Albert Einstein, even better than first class, belongs to the 0.5 class, while Niels Bohr, Erwin Schrödinger, Werner Heisenberg, Paul Dirac, Enrico Fermi, and some others belong to the first class. As for himself, Landau used to say that he was in the 2.5 class, and only ten years ago, satisfied with his work, he said he had reached the second class.

Landau holds a very high opinion of some of his young contemporaries whom he considers more capable than himself. One such is, for instance, Richard Feynman. In 1963, I met Feynman at a conference in Poland: He asked me some questions about Landau's health and about Landau himself. In the course of the conversation, I mentioned that Landau thought highly of the results of Feynman's work and considered that they were more important than his own. As far as I remember, Feynman became somewhat embarrassed and declared with resolution that Landau was wrong. This is naturally not the most important thing, however; I mention this incident merely to emphasize how much Landau is appreciated even by the very critically minded and outstanding theorists like Feynman.

Landau's very critical attitude and his opinion that many ideas (or, to be more precise, hints at ideas) are "pathological" spring in a substantial measure from his sober nature and clarity of thinking. His criticism and his denial of certain proposals are always based on scientific grounds and thoroughly deliberated arguments. It is quite a different thing that Landau does not always like to ex-

plain his remarks: Often he answers, "Think for yourself." The fact that he is not always ready to answer and explain, however, has nothing in common with conceit or snobbery. A profoundly democratic individual, he is alien to pomposity and respect for rank. Any student could discuss scientific problems with him without difficulty, with the single stipulation that held good for all: The student had to achieve the necessary level of understanding and analyze the problem instead of expecting Landau to think for him and do the things that the student could do himself.

At 54, his acumen was just as great as before. The level of his work had not deteriorated; the mastery of new techniques of calculations was not a problem for him. He remained at the front ranks of theoretical physics. It was the blow of a truck—a road accident—that took place on 7 January 1962, that interrupted Landau's work.

Catastrophes and their consequences are almost always incongruous. However, when it comes to the accident from which Landau suffered, it seems particularly incongruous and monstrously unjust.

An Interview

Lev Landau, laureate of a Lenin and a Nobel Prize, would like to write secondary-school textbooks on physics and mathematics.

"The first thing I will do when I get well is to try to set up a special commission at the Academy of Sciences to draw up new school curricula for eight-year instruction," he told a *Komsomolskaya Pravda* correspondent. "We are teaching children as we were taught 20–30 years ago. New textbooks are needed in many subjects."

Yesterday (22 January) he was 60 and was awarded the Order of Lenin in recognition of his great contribution to the advancement of physical science.

"No, I am not a many-sided scientist," Landau said. "I am just a theoretical physicist. I am really interested only in natural phenomena as long as they are unknown. To investigate them is no work for me; it is great pleasure, satisfaction, tremendous joy, which cannot be compared to anything."

The scientist regards Isaak Pomeranchuk, the physicist who died last year at the age of 53, as his favorite disciple ("How terrible that he died."). He also mentioned Arkadi Migdal, a nuclear physicist: "He is a very, very gifted man but lazy at times."

Landau's favorite writer is Nikolai Gogol. He also eagerly reads Byron in the original and singles out Konstantin Simonov among Soviet prose writers. "However, this has no bearing on my work," he said. "The world of science and the world of art are not in any way connected for me."

Recalling his training abroad in the early 1930s, Landau spoke with great warmth about Niels Bohr, in whose institute many young, and now world famous, scientists had worked. "Nearly every day we gathered at his institute in Copenhagen and engaged in endless discussions. Incidentally, these were not discussions as such, but a form of creativity, perhaps one of its highest forms."

Asked whether he had spoken with Einstein, Landau replied, "Yes, but little. It was difficult to speak with him since I did not interest him. Nobody interested him. He was too preoccupied with himself."

—NOVOSTI PRESS AGENCY (APN) ■