OBITUARIES

To notify the community about a colleague's death, send us a note at **http://contact.physicstoday.org**. Recently posted notices will be listed here, in print. Select online obituaries will later appear in print.

Alexei Alexeyevich Abrikosov

Alexei Alexeyevich Abrikosov, a 2003 Nobel laureate in physics, passed away on 29 March 2017 after a heart attack at his daughter's home in Palo Alto, California. Alex was one of the true greats of modern theoretical physics, and his presence will be sorely missed by the many who knew him.

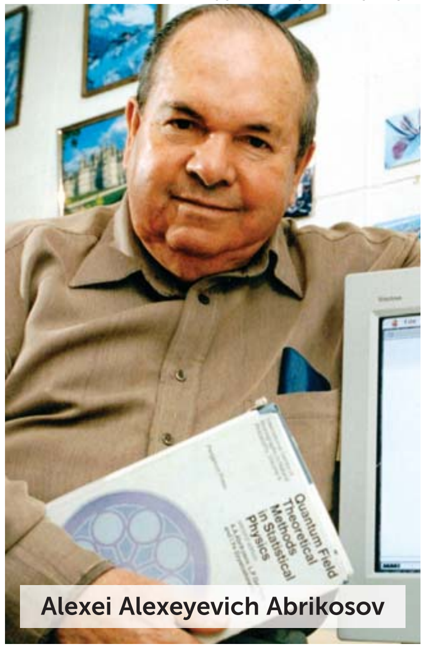
Alex was born in Moscow on 25 June 1928 into a family famous for establishing a confectionary that served the czar's family. His uncle was the Russian Empire's last envoy to Japan. His father, Alexei, vice president of the Academy of Medical Sciences, was entrusted with Vladimir Lenin's autopsy, and his mother, Fani, was also a well-known pathologist.

At the age of 19, Alex successfully passed Lev Landau's infamous "theoretical minimum" exams, and a year later he graduated summa cum laude from the physics department of Moscow State University. From that time until Landau's death in 1968, Alex was a close associate of his and was one of the founders of the Landau Institute of Theoretical Physics in 1964.

The 1950s were a time of great change in physics, and Alex was at the heart of it. With Landau and Isaak Khalatnikov, Alex made fundamental contributions to the theory of quantum electrodynamics. His studies in field theory, coupled with his interest in statistical physics, led to the 1961 monograph *Methods of Quantum Field Theory in Statistical Physics*, simply known as AGD after Alex and his coauthors, Lev Gor'kov and Igor Dzyaloshinskii. It became one of the most influential books in theoretical physics, and it popularized the so-called Matsubara technique for quantum field theory at finite temperatures. Because of the book's popularity, the technique became the *de facto* method for solving such problems.

One of the most charming pictures we ever saw graced Alex's home. A colorful drawing by theoretical physicist Alexei Tsvelik, it was done in the style of medieval illuminated paintings and shows

ARGONNE NATIONAL LABORATORY



Alexei Alexeyevich Abrikosov

Alex holding what looks to be a bible with the initials A. G. D. on the front, surrounded by a halo composed of drawings of his protégés.

In 1957 Alex published what became his best-known work, for which he would later receive the Nobel Prize. He formulated the theory of type II superconductivity by finding a new solution to the Ginzburg–Landau equations. Alex showed that the magnetic field will penetrate certain superconductors in an array of quantized vortices, now known as Abrikosov vortices, that allow superconductivity to survive to a much higher magnetic field. The solution solved many material puzzles that had been highlighted by the work of Lev Shubnikov and others on superconducting alloys. Type II superconductors are by far the more important class, since they are the basis for the high-field magnets used in hospital MRI machines and in the Large Hadron Collider. As Alex told it, he came up with the solution in 1952, but Landau did not believe it at first and only relented once Richard Feynman had published his own seminal work on vortices in liquid helium.

Alex and Gor'kov's work in 1960 on the influence of magnetic impurities for suppressing superconductivity demonstrated the advantage of the Green's function technique in the Matsubara representation for solving many-body problems and led to the novel concept of gapless superconductivity. That and related efforts by Alex and his colleagues paved the way to the field of mesoscopic physics.

In the 1960s Alex became interested in normal metals, semimetals, and semiconductors. His investigations of the Kondo problem revealed the presence of a resonance, now known as the Abrikosov–Suhl resonance, due to scattering of the conduction electrons off a magnetic impurity and also introduced the concept of "slave" particles. His work on gapless semiconductors and semimetals has seen renewed relevance these days after the discovery of graphene and topological semimetals. His encyclopedic knowledge of condensed-matter physics led to his 1987 textbook *Fundamentals of the Theory of Metals*.

Alex branched out into many areas, too numerous to list here, in the 1970s and 1980s. He was well known for his vigorous program of research at the Landau Institute and for his teaching at the Moscow Institute of Physics and Technology. He served as chair of theoretical physics at the Moscow Institute of Steel and Alloys starting in 1976 and was tapped as director of the Institute for High Pressure Physics in Troitsk in 1988.

In the wake of perestroika, Alex moved to the US in 1991 and accepted the position of Argonne Distinguished Scientist at Argonne National Laboratory. In 1992 he took over Argonne's condensed-matter theory group, which he led until 2000, but even afterwards he was an active member of the materials science division. At Argonne he continued to do interesting physics, particularly on van Hove singularities and on the phenomenon of linear magnetoresistance in semimetals—now in vogue after the discovery of topological semimetals.

The year after receiving the Nobel Prize, Alex developed macular degeneration, but he still came to the office every day until he had his first heart attack in 2016. After that, he and his wife moved to California to be with their daughter.

Life in the US was good for Alex. Over the years he mellowed quite a bit, and he was a valued colleague and hospitable host. Neither of us would be where we are in our careers if it were not for Alex. But you had to have time on your hands when you entered his office. Alex was a treasure trove of stories that he liked to regale you with. We always tried to get him to write his memoirs, but he refused, saying that he was such an honest guy that there would be too many people he would offend by doing so. We regret now not having written down the many wonderful stories he told.

Michael R. Norman
Argonne National Laboratory
Argonne, Illinois
Andrey A. Varlamov
Istituto SPIN-CNR
Rome, Italy

Leo Leroy Beranek

Leo Leroy Beranek, a global leader in acoustics, noise control, and concert hall design, passed away in his home in Westwood, Massachusetts, on 10 October 2016.

Born in Solon, Iowa, on 15 September 1914, Leo graduated from Cornell College in 1936 with a BA degree in math and physics. He was admitted into the doctoral program at Harvard University, where he worked under Frederick Hunt. His DSc degree was awarded in 1940 for his work on acoustic impedance; Leo developed a method for measuring it as part of his thesis and presented examples for many acoustical materials.

BOB LOTZ

Leo Leroy Beranek

The National Defense Research Committee established in 1940 the Harvard Electro-Acoustics Laboratory, and Leo was its director until 1946. The laboratory provided civilians the opportunity to work on military acoustical problems. Lightweight, sound-absorptive materials with a high ratio of surface to volume were needed to lower noise levels in airplane cockpits. Leo worked with a manufacturer to produce the materials. He helped design headsets and other devices to allow good communication in the presence of noise. The government needed echo-free space to test high-intensity noise sources, so Leo developed fiberglass wedges for use in what became known as anechoic chambers. Such rooms are still being built and used worldwide for electro-acoustic testing and determination of the noise emissions of products. While at Harvard, Leo received a Guggenheim fellowship to write his first book, *Acoustic Measurements*, published in 1949. The revised edition in 1998 contained a great deal of new information.

In 1947 Leo joined the MIT faculty as an associate professor for communications engineering. He taught a course on electrical network theory in the summer of 1951 and adapted that theory to the design of electro-acoustical networks. That led to the publication of his book *Acoustics* in 1954. The book also contained information on noise control and especially criteria for noise-control design, one of Leo's longtime interests. While at MIT, he established a series of noise-control courses for people working in industry. His 1960 book *Noise Reduction* came out of those courses. Later, his books *Noise and Vibration Control* in 1971 and *Noise and Vibration Control Engineering: Principles and Applications* with István Vér in 1992 became valuable sources of noise-control engineering information.

In 1948 Leo partnered with Richard Bolt, an MIT professor with training in physics and architecture, to found a consulting firm. Later, Robert Newman, an architect, was added, and the firm became Bolt Beranek and Newman (BBN). The first job was acoustical consulting for the United Nations building in New York. Among the many additional projects was successfully designing a very large muffler for the National Advisory Committee for Aeronautics (the forerunner of NASA) for a supersonic wind tunnel in Cleveland, Ohio. Leo described the noise situation before the muffler's installation: "The noise sounded like a series of thunderous explosions, even at distances as far as 5 or 10 miles away."

At the beginning of the jet age, noise from jet airplanes was rightly perceived to be louder than that from propeller planes. In his work with the Port of New York Authority, Leo established measures to reduce jet noise and, with others, developed a new noise metric called effective perceived noise level, or EPNdB, a variation of which is still used today in the certification of noise levels of commercial airplanes.

In 1955 Leo led the diversification of BBN into computer science, including hiring J. C. R. Licklider. BBN's contract with the Advanced Research Projects Agency led to the development of a packet-switching network that became ARPANET, the precursor of the internet.

Throughout his life Leo studied and consulted on the propagation, reflection, and absorption of sound in many of the world's best concert halls and on the effects of the sound fields on both the audience and performers. His books include *Concert and Opera Halls: How They Sound* (1996) and *Concert Halls and Opera Houses: Music, Acoustics, and Architecture* (2004).

While Leo was president of the Acoustical Society of America in 1954–55, he launched a technical journal, *NOISE Control*. In 1971 he and William Lang were leaders in the founding of the Institute of Noise Control Engineering (INCE-USA). During his presidency in 1972, INCE-USA established a series of international congresses called INTER-NOISE. Actions by Leo at the first congress led the federal government to pass the Noise Control Act of 1972. Leo also led the launch of the technical publication *Noise Control Engineering Journal*.

His final book, *Acoustics: Sound Fields and Transducers*, was written with Tim Mellow and published in 2012. It was a complete rewrite of the electro-acoustical and sound-field portions of his 1954 book *Acoustics*, with emphasis on the computer programming of the equations.

Leo received many honors and awards during his lifetime. Among them were the US President's Certificate of