

The UK's Royal Astronomical Society presented three medals in 2002. **Leon Mestel** received the Gold Medal in Astronomy for his work on a variety of stellar and galactic problems, especially ones involving magnetic fields. He is an emeritus professor of theoretical astrophysics at the University of Sussex. The RAS presented its Gold Medal in Geophysics to **John Arthur Jacobs**, who retired as a professor of geophysics from the University of Cambridge in 1983. The society noted that he is "probably best known for his work on the Earth's core and the properties and dynamics of the Earth's magnetic field." **Douglas Gough**, director of the Institute of Astronomy at the University of Cambridge, received the Eddington Medal. The citation notes that his "achievements in clarifying the properties of stars and stellar oscillations make him an eminently appropriate recipient."

After 21 years at AlliedSignal (now Honeywell International) in Morristown, New Jersey, most recently as a senior principal scientist, **Sanjeeva Murthy** joined the University of Vermont last month as an associate professor of physics.

At its annual meeting this month in Salt Lake City, Utah, the Society of Exploration Geophysicists, headquartered in Tulsa, Oklahoma, will be presenting the Maurice Ewing Medal—the society's highest award—to **Gordon F. West**. The society is honoring West, emeritus professor in the University of Toronto's physics department and a consultant to several mineral exploration companies, for his "important contributions to the science of geophysics, both personally and through his supervision of generations of graduate and undergraduate students." West codeveloped, with Yves Lamontagne, the University of Toronto electromagnetic method, which "has been credited for the discovery of several important base-metal deposits," and that he coauthored, with Fraser Grant, the textbook *Interpretation Theory in Applied Geophysics* (McGraw-Hill, 1965), which "has been used to teach thousands of geophysics students over the past 37 years."

In July, **Alan E. Waltar** became the director of nuclear energy at the Pacific Northwest National Laboratory in Richland, Washington. He retired in June from Texas A&M University as head of the nuclear engi-

neering department, a position he had held since 1998.

**Leo P. Kouwenhoven** and **Ullrich Steiner** shared this year's Sackler Prize in the Physical Sciences, which carried a cash award of \$50 000. The prize's subfield for 2002 was engineered materials. Tel Aviv University, which presented the award last May, recognized Kouwenhoven for his "seminal contributions to our understanding of electronic states and charge

transport in submicron systems." He is a professor of physics in the department of nanoscience at the Delft University of Technology in the Netherlands. TAU acknowledged Steiner for "innovative discoveries in the analysis and control of the structure and shape of thin polymeric films at the submicron scale." He is a professor of polymer chemistry at the University of Groningen in the Netherlands and is also affiliated with the university's Materials Science Center.

## OBITUARIES

### Nikolai Gennadievich Basov

Nikolai Gennadievich Basov died of heart failure in Moscow on 1 July 2001. A Nobel Prize winner, he was one of three founders, together with Aleksander Prokhorov and Charles Townes, of a new branch of science and technology known as quantum electronics, or laser physics.

Basov was born on 14 December 1922 in Usman', a small Russian town in the Lipetsk region. During his last years in school, the Soviet Union entered World War II, and he served in the military as a student of the Military Medical Academy (1941–43) and as an officer of a chemical defense battalion in the First Ukrainian Front (1944–45). In 1946, he enrolled at the Moscow Engineering Physics Institute and graduated in 1950 as an engineer-physicist. He completed his PhD thesis in 1959 under the guidance of Michael Leontovich and Aleksander Prokhorov and received his Candidate of Science degree from the P. N. Lebedev Physical Institute. He eventually worked his way up from junior scientist to director of the Lebedev Institute, maintaining an affiliation there until the last day of his life.

In 1952, Basov and Prokhorov were the first to demonstrate, based on a theoretical analysis, the feasibility of constructing generators and amplifiers of electromagnetic waves using the phenomenon of stimulated transition in quantum systems with population inversion of levels. As early as 1955, they proposed a highly effective principle for achieving population inversion by pumping a three-level system, a technique that is now widely used in various lasers and spectral ranges. Others applied this novel principle to fundamentally new



NIKOLAI GENNADIEVICH BASOV

devices such as low-noise microwave amplifiers and generators (masers).

In 1956, Basov received his DSc degree for his thesis entitled "A Molecular Oscillator." His thesis was a notable accomplishment in the scientific life of the Lebedev Institute: His fundamental findings were so brilliant and unexpected that the most authoritative scientists were invited as reviewers. Symbolically, Il'ya Frank, a winner of the 1958 Nobel Prize in Physics, played the decisive role with his positive review. In 1964, Basov, Prokhorov, and Townes won the Nobel Prize in Physics for fundamental investigations in the field of quantum electronics, which led to the discovery of masers and lasers.

In his thinking, Basov apparently followed a logic that contrasted with thinking based on the most simple procedure, that is, moving from basic physics, as outlined in textbooks, to more complex concepts. Sometimes it seemed that he followed the opposite

direction in his reasoning! For example, during the 1950s, while addressing the linewidth of a maser radiation, Basov posited that the stimulated-radiation line might be narrower than the natural linewidth because of regeneration in the cavity. It was recounted that Lev Landau (recipient of the 1962 Nobel Prize in Physics), to whom Basov came for advice, initially rejected this possibility. Landau's rejection seemingly followed from the uncertainty principle. However, later on, the phenomenon was explained reasonably well by using the principle of indistinguishability of molecules entering the cavity and those leaving it in a certain quantum state.

Basov and his coworkers performed extensive series of investigations that led to the construction of a broad family of new lasers: photodissociation (atomic iodine) based on the pumping by a strong shock wave, electron-beam-controlled, excimer, chemical, and other lasers. Basov was the first scientist in the world to propose the use of semiconductors as the active medium of lasers excited by a variety of methods, including injection across a p-n junction. That method has led to the advent of injection diode lasers that are widely used in both science and technology.

In 1962, Basov, who was concerned with global problems, put forward the idea of achieving a thermonuclear fusion reaction by laser irradiation of a small target. At that time, laser output energies were so small that, initially, the idea seemed unrealistic. However, because of his scientific courage, inexhaustible energy, stubbornness, persistence, and faith in the correctness of the scientific idea, Basov achieved the seemingly impossible: The first thermonuclear laser neutrons were generated at the Lebedev Institute in 1968 by laser irradiation of a lithium deuteride target. Those results provided a powerful stimulus for the study of laser thermonuclear fusion throughout the world. At present, many regard laser fusion as one of the promising approaches to the peaceful use of thermonuclear energy.

Apparently, Basov thought it essential to construct the model of a phenomenon in his own specific way, different from (and probably more complex) than that of his colleagues. This unique thinking was the source of the best ideas that were characteristic of his creativity. Usually it is believed that if a single idea from 10 ideas gives rise to a practical implementation, the effort is a great success. But for Basov,

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the percentage of ideas that were implemented was much higher. There are three levels of cognition: At the first stage, one observes a new phenomenon; at the second stage, one explains this phenomenon; and, at the third stage, one uses the obtained knowledge as a research and application instrument. Many experimentalists restrict themselves to the first stage; theoreticians, to the second; and only a few outstanding scientists reach the third stage. Basov belonged to the third group.

Basov was persistently attached to science, without which he apparently thought life was empty. Physics as science or physics as technology occupied his mind whether he was at home, in a car, on holiday, or ill. He was a scientist who devoted all his strength, knowledge, and enormous talent to the development of science in Russia.

Basov was frank and straightforward in judgment, a characteristic that was not always appreciated by his associates. Some believed that he underestimated their work and accomplishments, but in actuality, he was strongly devoted to laser physics, which, for him, left little room for other realms of knowledge. He was, though, an outstanding proponent of other people's ideas and accomplishments. He had a surprising intuition and was a generous, hard-working, and friendly person. These traits attracted and held scientists and students around him.

Basov depended on the people who surrounded him—friends with whom he had studied at the Moscow Engineering Physics Institute, and colleagues and disciples with whom he worked at the Lebedev Institute. He and his wife Ksenia were hospitable hosts for whom no holiday or family event would pass without numerous guests.

The international reputation of the Lebedev Institute and its scientists is the result of the long and distinguished activity of Basov. With his death, the physics community has lost one of its brightest and most admired members.

**OLEG KROKHIN**

*P. N. Lebedev Physical Institute  
Moscow, Russia*

## James Thomas Cushing

James Thomas Cushing, professor of physics, philosophy, and the history and philosophy of science at the University of Notre Dame, died at his



**JAMES THOMAS CUSHING**

home in South Bend, Indiana, on 29 March 2002.

Jim was born 4 February 1937 in Long Beach, California. In 1959, he earned a BS in physics from Loyola University Chicago; a year later, he earned an MS in physics from Northwestern University. For his doctorate, he focused his research on theoretical particle physics under the guidance of adviser Max Dresden. Jim received his PhD in 1963 from the University of Iowa.

Jim's dissertation and early publications in the mid-1960s concerned the development of the S-matrix program, his specific contribution being to show that the Mandelstam representation obtained for a large class of nonlocal potentials. In the late 1960s and early 1970s, Jim turned his attention to the question of whether the Chew and Mandelstam bootstrap mechanism could yield internal symmetries such as isospin and SU(3). He made one of his most important contributions to theoretical physics in 1975 with the publication of *Applied Analytical Mathematics for Physical Scientists* (Wiley, 1975), which quickly became a standard textbook.

As the fortunes of the S-matrix program waned, Jim's interests shifted to the history and philosophy of physics, areas in which he was to become a leading figure. During this phase of his career, he masterfully studied the history of the S-matrix program, which he wrote about in *Theory Construction and Selection in Modern Physics: The S-Matrix* (Cambridge U. Press, 1990). But surely one of the most cited books on the history and philosophy of physics during the past decade is Jim's *Quantum Mechanics: Historical Contingency*

and the Copenhagen Hegemony (U. of Chicago Press, 1994). Another important work is the collection Jim coedited with Ernan McMullin, *Philosophical Consequences of Quantum Theory: Reflections on Bell's Theorem* (U. of Notre Dame Press, 1989).

Jim's reputation among physicists was based mainly on his well-known insistence on a fair hearing for Bohmian mechanics as an alternative in debates about the interpretation of quantum mechanics. What most interested Jim, however, was not advocating David Bohm's program over orthodox Copenhagen quantum mechanics, but rather achieving a deeper understanding of how the sociology of scientific communities plays a role in the acceptance and rejection of scientific theories. In the undergraduate textbook *Philosophical Concepts in Physics: The Historical Relation between Philosophy and Scientific Theories* (Cambridge U. Press, 1998), he expressed his concerns with the way science lives in a social and historical context.

Jim's graduate students remember him as an extraordinarily conscientious and supportive dissertation director. Many of the same moral traits that made Jim a much-loved teacher were also in play in his lifelong dedication to social justice, as evidenced especially by his involvement in the civil rights movement of the 1960s. Jim's Notre Dame physics colleagues recalled one typical episode in the late 1960s when, on the verge of tenure, Jim suddenly announced his resignation. Pressed by the chairperson for the reason, Jim explained that he was accepting a fellowship from the Woodrow Wilson Foundation to spend a year teaching physics at the Hampton Institute. He added that he did not want to put his own department in the awkward position of having to grant leave to a junior faculty member for a purpose having nothing to do with his own professional advancement or enhancing the academic reputation of Notre Dame. His Notre Dame colleagues warmly supported him for doing what his conscience demanded.

To honor Jim's memory, his family, friends, and colleagues have established the Cushing Memorial Prize, an award given annually by the University of Notre Dame for young scholars' work in the history and philosophy of physics.

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