gamma rays, it brought on a surge of development in the physics of radiation in these spectral regions.

In 1934, Cauchois pointed out that one could focus x-ray radiation with a curved crystal used in reflection for use in monochromators for x-ray scattering and then later in soft x-ray high-resolution spectroscopy. She was a pioneer in the development of x-ray imaging techniques using a curved crystal. During the 1930s and 1940s, she established the energy levels of atoms, singly or multiply ionized from an inner shell, to prove the existence of rare elements such as polonium and astatine and to develop actinide spectroscopy. After becoming the head of the Laboratory of Physical Chemistry, she focused on the subject of x-ray absorption and emission in solids and chemical effects on x-ray spectra.

In Europe, Cauchois was the first to develop and use sources of synchrotron light, initially at the National Laboratories of Frascati near Rome from 1963 to 1964, and in the early 1970s at LURE (Laboratory for the Use of Electromagnetic Radiation) in Orsay, France. She also became interested in extraterrestrial x-ray radiation; the Laboratory of Physical Chemistry collaboration with astrophysicists led to the obtainment of x-ray images of the Sun in 1970.

Cauchois made important contributions to the production of electron beams and the study of their interaction with matter, and to research on nuclear fluorescent resonance. Under her guidance, the Laboratory of Physical Chemistry was, for a long time, the only French center engaged in fundamental research in x-ray spectroscopy.

She was the second woman, after Marie Curie, to be president of the French Society of Physical Chemistry. She created an excellent teaching program of modern chemical physics and surrounded herself with competent colleagues in every discipline who were dispersed among many laboratories in France and abroad. When the laboratory at the Rue Pierre et Marie Curie in Paris became too small, she created a center for chemical physics at Orsay during the 1960s, long before the University of Paris XI was established. With zeal for her subject, she made progress in a field of French research during a period when few women dedicated themselves to science.

In 1933, Cauchois received the Ancel Prize from the French Physical Society. She received four prizes from the French Academy of Sciences: the Henri Becquerel Prize in 1935, the Gizbal-Baral Prize in 1936, the Jerome Ponti Prize in 1942, and the Triossi Prize in 1946. She also was awarded the Henry de Jouvenel Prize in 1938 by the French Ministry of Education and the Medal of the Czechoslovak Society of Spectroscopy in 1974. In the 1960s, Cauchois was decorated as Commander of the Order of the Ministry of Education, Officer of the Honor Legion, and Officer of the National Merit by the French Republic. She received the Gold Medal of the University of Paris in 1987.

Cauchois was not only a woman of science, but she showed great interest in young and underprivileged people to whom she extended emotional help as well as material support. She had a great sense of humor and knew how to entertain others with her storytelling. She enjoyed the arts, particularly music—she was an expert on the grand piano—and she loved poetry. Her colleagues will remember her as someone who gave the best part of her life to her laboratory.

CHRISTIANE BONNELLE
University of Paris VI
France

Klaus Halbach

Klaus Halbach, a long-time staff physicist with the Lawrence Berkeley National Laboratory (LBNL) and an international expert in magnetic systems for particle accelerators, died on 11 May 2000 following a long and courageous battle with prostate cancer.

Born on 3 February 1925 in Wuppertal, Germany, Klaus received his PhD in nuclear physics from the University of Basel, Switzerland, on work involving nuclear magnetic resonance (NMR). After a three-year stint teaching at the University of Fribourg in Switzerland, Klaus came to the US in 1957 on a grant from the Swiss National Fund to work at Stanford University with a pioneer of NMR, Nobel laureate Felix Bloch. Klaus revered Bloch as both a colleague and a teacher.

In 1960, Klaus joined the precursor to LBNL, the University of California Radiation Laboratory. There, he worked in the magnetic fusion group in the area of plasma physics. Following a nearly one-year return to Fribourg, where he was an assistant professor and started a plasma physics group, Klaus returned to LBNL permanently, where his first assignment was to lead the homopolar plasma generator project. His work with plasma physics led him into accelerator

KLAUS HALBACH

design. In one of his first design endeavors, he made a major contribution to the Omnitron; that design laid the groundwork for the Bevelac.

For all his success as an accelerator designer, Klaus is probably best known for his later work on magnetic systems for particle accelerators. He and his colleague (and later son-in-law) Ron Holsinger developed the famous POISSON package of computer codes for solving the Laplace equation—codes still in use today. Building on the expertise he developed in analyzing and designing conventional magnets, Klaus went on to become one of the world's premier designers and developers of permanent magnet systems, primarily for use in wigglers and undulators. His contribution to the development of these permanent magnet insertion devices as synchrotron radiation sources was instrumental in the worldwide development of so-called third-generation light sources such as the Advanced Light Source and Advanced Photon Source. In 1995, in recognition of this work, the Advanced Photon Source Users Organization at Argonne National Laboratory awarded the Arthur H. Compton Prize jointly to Klaus and Nikolai Vinokurov.

Klaus was a consultant on accelerator projects and synchrotron light sources around the world, including the accelerator divisions at the Nuclear Physics Institute Jülich—now called the Research Center Jülich—in Germany and Los Alamos National Laboratory; the Stanford Synchrotron Radiation Laboratory; and the Advanced Photon Source at Argonne National Laboratory.

Although the only formal teaching position Klaus actually held was

during his brief appointment at Fribourg, his contributions as a teacher were probably as significant as those he made as an applied researcher. The technical lectures he delivered were of outstanding clarity and presented in a way that invariably held the attention and interest of his audience. But more important was his ability—one might almost say his compulsion—to impart his ideas to anyone willing to listen, and even occasionally to those who weren't.

The occasion for such one-on-one teaching was often one's approaching Klaus with a difficult physics problem. He would supply the solution (which he invariably described as "trivial") a day or so later, accompanied by an offer to explain further if there was any need. There almost always was. So Klaus would proceed to give a tutorial, not merely on the example at hand, but on a variety of related subjects, delivered with the enthusiasm and excitement he must have felt upon first learning it himself. He showed one the wonderful physics, and he made it fun. As a result, among the practicing physicists around the world are dozens who are, to use Klaus's colleague Brian Kinckaid's phrase, "alumni of Halbach U."

Klaus's inquisitiveness and enthusiasm as a physicist and teacher allowed him to work passionately and productively until a few months before his death. In the last year of his life, despite his illness, Klaus avidly continued to work. Nothing delighted him more during this time than to have colleagues come by to discuss their scientific work.

After Klaus's death, numerous tributes from physicists around the world were shared at a memorial service. Perhaps none of them summarized the impact of his loss as well as the following: "In some ways, [it] is like losing both a friend and a father. Many times, when you have a question or a new idea, you think, 'What would Klaus think about or say to that?' Now there is no one to turn to."

HERMAN WINICK
KARL BROWN
SLAC
Stanford, California
DAVID GOLDBERG
Lawrence Berkeley National Laboratory
Berkeley, California

Klaus W. Kehr

Klaus W. Kehr, a theoretical condensed matter physicist with the Institute of Solid State Research at the Research Center Jülich in Germany, died 9 March 2000 in Cologne, Germany, after a battle with a short but malignant disease.

KLAUS W. KEHR

Klaus was born on 16 July 1934 in Nürnberg, Germany. He earned his *diplom* in physics in 1961 from the Technical University of Munich. He obtained his doctoral degree in physics from the same university in 1965. His doctoral work, performed under the supervision of Wilhelm Brenig, was on the theory of superfluid helium-2.

Klaus's first research position was at the Max Planck Institute for Physics and Astronomy in Munich, where he conducted research in solid-state physics. He left that institute in 1969 for Cornell University, where he took a two-year position as research associate with the Laboratory of Atomic and Solid State Physics. On his return to Germany in 1971, he joined the newly founded department of solid-state physics at the Research Center Jülich as a scientific member. The intense interaction between experimentally and theoretically inclined researchers within this department initiated his lifelong interest in diffusion theory.

Klaus's work was initially motivated by phenomenological considerations; he particularly attempted to understand neutron scattering results on hydrogen diffusion in metals. However, he very quickly put his models in a more general and mathematical framework, which made them applicable to a wide range of diffusion phenomena. He pursued and advanced the theory of diffusion processes throughout his scientific career. An outstanding example is his work on the dynamics of muon spin depolarization in the presence of disorder.

A successful researcher and gifted and dedicated academic teacher, Klaus obtained his lecturing qualification *(habilitation)* in 1975 from the University of Cologne. He was appointed as a professor of physics at Cologne in 1985. He also continued to work for the Research Center Jülich. The undergraduates whom he lectured at Cologne as well as the advanced students at the Research Center Jülich enjoyed and profited from his careful, pedagogic, and methodical approach, his obvious dedication to physics, and his subtle humor.

His insistence on clear presentation is evident in the more than 100 papers he wrote or cowrote. The review article "Diffusion in Regular and Disordered Lattices," which he published together with Joseph Haus in *Physics Reports* in 1987, is an important reference work for condensed matter physicists.

Klaus had no ambition to become a powerful science administrator—he loved science and wanted to stay in it. But his sense of duty and responsibility toward the department of solid-state physics nevertheless led him to accept, on three occasions over the years, the position of acting director of the theory group of which he was a member; the various directors had left and could not be replaced quickly. Between 1976 and 1999, he guided the departmental staff with empathy, competence, and a penchant for perfection.

Visitors and students from abroad who initially were drawn to him because of his international reputation invariably left as friends and admirers because of his kindness and modesty combined with a sharp intellect, scientific prowess, and encyclopedic knowledge of his field. Communication with Klaus was easy because of his love for and versatility with foreign languages; for example, he could speak English, French, and Japanese.

When he retired on 31 July 1999, he was full of plans to continue scientific work at the institute and to spend more time with his family and on his passion for hiking and mountaineering. Sadly, he became ill and was unable to pursue those plans. His family and many friends worldwide will remember him as a warm-hearted man and an enthusiastic scientist.

WOLFGANG EBERHARDT
GERT EILENBERGER
HEINER MÜLLER-KRUMBHAAR
Research Center Jülich
Jülich, Germany ■