obituaries

promoting research and encouraging young associates. Through participation in his research program, a number of young, active physicists grew up and have established themselves in their respective fields of science.

In 1949 he was invited to the Institute for Advanced Study in Princeton. During a year of his stay there, he did a nice piece of work on the many-body problem of a one-dimensional fermion system. This theory was later extended to collective motion in a more general fermion system.

After Nishina died in 1951, Tomonaga took over Nishina's administrative responsibilities. He made efforts to establish inter-university institutes, including the Research Institute of Fundamental Physics and the Institute of Nuclear Study respectively affiliated to Kyoto University and Tokyo University respectively. He defined the concept of inter-university institutes in which scientists from participating universities can join in the activity of the institute as their own right.

After 1956 he halted his scientific research to serve as President of the Tokyo University of Education for six years, and as President of the Science Council of Japan from 1963 to 1969.

After his retirement in 1970, he started to write the third volume of his book *Quantum Mechanics*. The first and the second volumes have been very popular, as indicated by the several hundred of thousand copies sold. Although he planned to discuss field theory in his own way, the third volume was left unfinished. He also became interested in the history of physics and wrote two books: *The Spin is Spinning* which tells stories about quantum theory, and *What Would Be Physics, I*, which describes underlying thoughts of mechanics and thermodyanmics. Since both are written in colloquial language, they display his wit. It is our great sorrow that Tomonaga left unfinished the manuscript from volume II, which would have described statistical mechanics, electromagnetism and atomic physics.

SATIO HAYAKAWA
Nagoya University

Lew Kowarski

Lew Kowarski, a pioneer in the development of nuclear fission, died on 30 July at the age of 72.

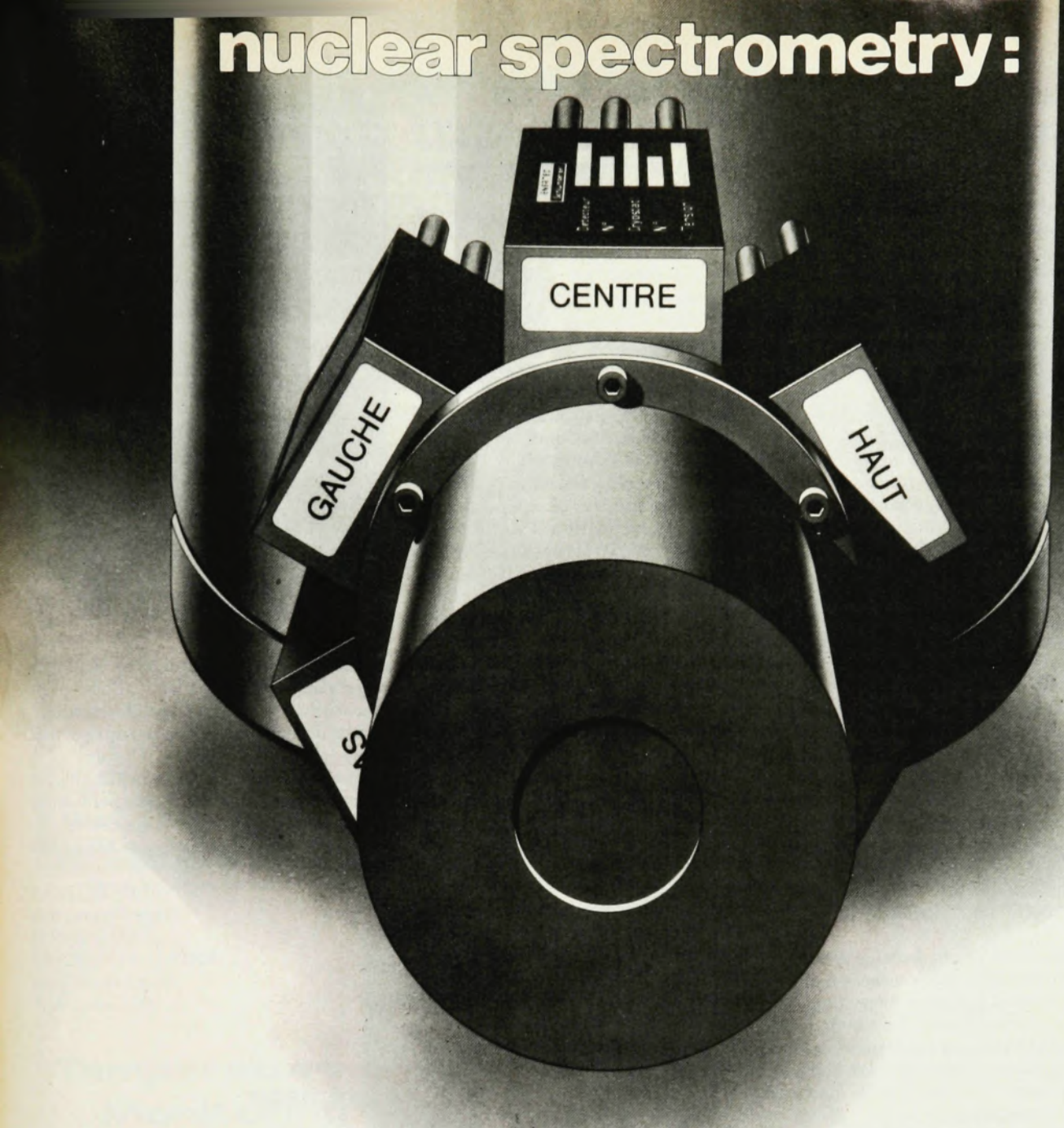
When Kowarski arrived in Chalk River, Canada to join the Anglo–Canadian nuclear reactor team (of which I was division head) in August 1944, John Cockcroft immediately put him in charge of building the first nuclear reactor to function outside the US. I had not seen him since the declaration of the war in 1939. We met at the Curie Laboratory in Paris in the mid-1930's at the beginning of our respective careers. He was then a silent and self-conscious giant who had not yet found his field of research. Being a foreigner in France at that time (he was born in Russia in 1907, brought up in Poland after the 1917 revolution and took his degrees at Ghent in Belgium and at Lyons in France) and without any financial means, Kowarski was obliged to take a part-time job in industry. This job enabled him to spend the rest of his time working under Jean Perrin for his PhD in molecular physics and later with Frederic Joliot.

Kowarski finally made a brilliant entrance into the scientific world in 1939, the year he became a French citizen. He was responsible for one of the experiments (performed with Joliot and Hans Halban) that proved, for the first time, the formation of secondary neutrons in the recently discovered phenomenon of uranium fission. Later that year, he wrote (with others) some secret French patents—the first to describe the principle of today's nuclear reactors. Years later, in 1968, the US Atomic Energy Commission recognized his contributions to atomic energy with a citation award.

Prior to France's surrender, the last French government sent Kowarski and Halban to England to continue their research with the world stock of heavy water: 180 kilograms recently purchased from Norway. In December 1949 at the Cavendish Laboratory, the pair produced the first evidence of the feasibility of a chain reaction with uranium. In late 1942, Halban was chosen to direct an Anglo–Canadian team in Montreal pursuing the work with heavy water. His decision to leave Kowarski in Cambridge created a near revolt among the team where the latter had become extremely popular and respected. Kowarski arrived in Canada in the summer of 1944 only after Halban was replaced by Cockcroft as the head of the Laboratory.

For me, Kowarski was now a completely different man. He had blossomed in Britain partly due to his linguistic talent, which afforded him a perfect command of English after only a few months in Cambridge. All his qualities had suddenly become apparent: his clear perception of scientific and world problems helped by an extraordinary memory, his brilliant way of expressing himself and explaining the most difficult technical or human questions, his wit and ever-accompanying laughter, which may have concealed a deep feeling of insecurity. He also had perfect pitch and was able to play a correct tune on the piano even while turning his back to the instrument.

Though he definitely felt happier in the Anglo–American world, he believed it was his duty to help his adopted country recover the place it had occupied before the



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war in the nuclear competition. Therefore he returned to France in the beginning of 1946 and became the Scientific Director of the newly created Commissariat a l'Energie Atomique, of which Joliot was the High Commissioner.

With efficiency and ease, he led the team that built the first French reactor, which he named ZOE (he loved giving names to projects and reactors). He was also responsible for the construction of the second one. He was suddenly one of the best known scientific figures in France and there seemed to be no limit to his success. It was therefore a surprise to all his colleagues when he then decided to try to go back to the Anglo-Saxon world. However, he had often mentioned that one day he wanted to be a part of a scientific international organization.

Eventually this wish was granted, not in the field of fission, but in the more advanced one of high-energy physics. He was instrumental in the early 1950's in setting up CERN. In 1954, he became its first Director of Scientific and Technical Services. He then created the Data Handling Division, which he directed until his retirement in 1972. Parallel to this activity he took a lively interest in the Nuclear European Agency of the OECD as scientific adviser. He also taught for part of each year at an American university (Purdue University, University of Texas at Austin and Boston University).

At the end of his life he became more and more interested in the interaction of science and society and gave many popular lectures on the subject. He was then also involved in the major problem of the public acceptance of atomic energy and, much to the regret of many of his former colleagues, he became very opposed to the breeder reactor as well as to a too-rapid introduction of atomic energy. He will be nevertheless remembered as one the most original of the great pioneers.

KOWARSKI

BERTRAND L. GOLDSCHMIDT
Comissariat à l'Energie Atomique
Paris, France

Peter H. Mark

Peter H. Mark, professor of electrical engineering and computer science at Princeton University, died on 26 September. He was 48 years old.

Mark was a recognized authority on the free surface properties of semiconductor materials, the correlation of surface electronic and atomic structure as well as the chemical activity of surfaces. He was one of the founders of the now annual Conference on the Physics of Compound Semiconductor Interfaces. Since 1975, Mark had also been editor of the *Journal of Vacuum Science and Technology*. Active in the American Vacuum Society for over a decade, he was a member of the Board of Directors from 1974 to 1975 and chairman of the Thin Films Division in 1975. As a member of the American Institute of Physics Publications Board and its Publications Policy Committee, Mark made important contributions to the Institute's publication policies.

In 1938, Mark's father, Herman (a physical chemist—now emeritus dean at Polytechnic of New York), brought the family to the US from Germany. Both Mark and his brother, Hans (former director of the Ames Research Center and now Secretary of the Air Force) studied physics in school. Mark received a BA from Harvard College in 1953, and MS from Yale University in 1954 and a PhD from New York University in 1958. Mark assumed a professorship at Princeton in 1966, prior to which he held positions at Polaroid Corporation and RCA Laboratories. During his thirteen years at Princeton, he supervised thirty doctoral students and many research associates who have since taken positions in industry and academia. Besides the *Journal of Vacuum Science and Technology*, Mark's major consuming interest was helping the careers of young scientists and engineers. For example, he provided the members of his research group with exposure to industrial as well as academic experience by arranging joint projects with RCA Laboratories and the Xerox Webster Research Center. In recent years his group was responsible for several important results in semiconductor surface science, including the first determinations of the atomic geometries of a number of semiconductor surfaces and significant work on the oxidation of these surfaces.

In addition to his leadership role in the AVS and the AIP, Mark was a senior

MARK

member of the IEEE and a fellow of The American Physical Society. Those of us who worked with Mark found him an enthusiastic contributor, trusted adviser and loyal friend. He leaves a legacy of a journal that has grown considerably in size, scope and prestige, a group of former students who are contributing actively to the scientific and engineering life of the US and good friends who will miss him.

CHARLES B. DUKE
Xerox Corporation
Rochester, N.Y.
JOHN L. VOSSEN, JR
RCA Laboratories
Princeton, N.J.

Frank Bader

Frank Bader, 60, a physicist at the Johns Hopkins University Applied Physics Laboratory died on 17 June in Highland, Md.

A specialist in missile systems, propulsion design and fleet communications, Bader was with the laboratory since 1948. Between 1958 and 1965 he helped develop and test the ramjet engine of the Talos guided missle, the world's first long-range anti-aircraft missile designed for fleet defense. Later, Bader worked on life-support systems for space environments. In 1977, he was involved in the evaluation of the US Fleet's inter-ship communication system.

Bader received a bachelor's degree in physics from the College of William and Mary in 1940 and master's and doctoral degrees from the University of Virginia in 1944. He was a research physicist at the University of Virginia from 1944 to 1946. Before joining Johns Hopkins, Bader was a radio applications engineer for Bendix Aviation Corp. and a physicist at the Kellex Corp. □