JOHN REGINALD RICHARDSON

in the stable bucket. In 1946, he led an *ad hoc* group consisting of Ed Lofgren, Ken MacKenzie, Bernard Peters, Fred Schmidt and Byron Wright in converting the fixed-frequency 37-inch cyclotron at Berkeley to FM operation as the first synchrocyclotron. This success not only provided the first demonstration of the phase-stability principle (Frank Goward and D. E. Barnes's first operation of a synchrotron followed a few months later), but also confirmed the feasibility of converting the 184-inch cyclotron from a classical cyclotron to a synchrocyclotron.

That same year, Reg took up a faculty appointment at UCLA and was soon joined by MacKenzie and Wright, and also by David Saxon. Together, they formed a strong nuclear physics group and brought the 37-inch cyclotron from Berkeley. The conversion of this machine to a 20 MeV synchrocyclotron provided not only a leading research facility, but also an essential tool for the many graduate students attracted there.

The many higher-energy synchrocyclotrons built in the ensuing years, along with electron synchrotrons, made secondary beams of pions and muons available and inaugurated the era of accelerator-based particle physics. But the pulsed operation of those machines limited beam intensities to about 1 microamp, so the need for intense 200–300 MeV deuteron beams led to the construction of the 60-foot-diameter Mark I linear accelerator. Reg championed a more modest alternative—a CW cyclotron based on Llewellyn H. Thomas's prewar suggestion of using a magnetic field that increased radially to maintain fixed-orbit frequency into the relativistic regime, while varying azimuthally to provide axial focusing. He had kept his Berkeley connections, and there, in 1950, he led David Judd, John Jungerman, Elmer Kelly, Robert Pyle, Robert Thornton and Wright in building the first sector-focused cyclotron—an electron model that achieved v/c values of 0.5.

Such cyclotrons are harder to tune than synchrocyclotrons and require a very accurately tailored magnetic field. Such precision could not be achieved by shaping the iron alone, but required the adjustment of over 50 trimming coils, using the beam as a probe. Reg's skill and perseverance in bringing the beam to full energy led one of the engineers, who normally classified experimental physicists as "2-knob men" or "4-knob men" according to their tuning ability, to concede that here was a "10-knob man."

This work remained classified until 1955, but once the secret was out, sector-focused cyclotrons rapidly proliferated. Back at UCLA, Reg led the design and construction of a 50 MeV cyclotron that took full advantage of Donald Kerst's spiral sector focusing and Wright and Martin Rickey's H^- ion acceleration concept to provide clean beam extraction at variable energy. Completed in 1962, the cyclotron greatly increased the range of experiments available. Reg was determined to show that a small lab could be the first to produce relativistic protons at high intensity and, in fact, won the race by a year.

His 1963 proposal for a 750 MeV H^- cyclotron "meson factory"—a term he coined—was unsuccessful at UCLA, but adopted in Canada in a downsized version that led to the construction of the 520 MeV, 200 μA TRIUMF cyclotron in Vancouver. Reg presided over TRIUMF's construction and commissioning with great effectiveness as the facility's second director from 1971 until 1976.

In his supposed retirement, he initiated the drive for the KAON Factory at TRIUMF and, always out ahead, was already working on the 100 GeV extension before the ink was dry on the 30 GeV proposal!

Throughout his career, Reg continued to participate in nuclear and particle physics experiments. Most notable, perhaps, were the experiments that resulted in the introduction of the Kurie plot for determining β-decay energies, the first measurement of the charged pion's lifetime (surely one of the last papers to report the measurement of a fundamental particle property by a single author!) and the elucidation of nucleon–nucleon scattering from 14 MeV through to 520 MeV.

His greatest legacy, however, must be the more than 200 sector-focused cyclotrons now in operation worldwide, whose intense beams have had a major impact on nuclear and particle physics, condensed matter physics, chemistry and medicine. Reg was awarded the American Physical Society's Wilson Prize in 1991.

Reg will be remembered not only for his monumental achievements and his impact on generations of nuclear and accelerator physics students, but also for his elegant style and for the warm hospitality that he and his family bestowed on so many of his colleagues.

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Norman Carroll Koon

On 29 December 1997, the magnetism and condensed matter physics community lost one of its outstanding researchers: Norman Carroll Koon, a physicist at the US Naval Research Laboratory (NRL) in Washington, DC, was killed in a skiing accident while vacationing at White Tail ski resort in Pennsylvania.

Born on 8 July 1938, in Sheridan, Arkansas, Koon was educated at the Georgia Institute of Technology, where he received a bachelor's degree in engineering in 1960 and a PhD in physics in 1970 for research on the Mössbauer effect.

Soon after joining NRL in 1969, Koon and Arthur Clark of the Naval Surface Warfare Center (NSWC), who was working independently, discovered the large magnetostrictive properties of the (rare earth) Fe_2 Laves-phase class of materials that are now used in magnetostrictive transducers. Over several years, Koon intensively researched those systems, with the aim of understanding their exchange, magnetic anisotropy and magnetoelastic properties.

From the early results of their magnetization studies, Koon and Conrad Williams developed $Ho_{0.58}Tb_{0.20}Dy_{0.22}Fe_2$, a low-anisotropy, high-magnetostrictive material.

Koon also developed the technique for producing high-quality single crystals of rare earth compounds. That success enabled Koon and me (I was then at the National Institute of Standards and Technology) to study the exchange and anisotropy directly with inelastic neutron scattering. As our research progressed, Koon not only became rapidly expert at determining spin wave dispersion, but also devel-

NORMAN CARROLL KOON

oped the Green's function pseudoboson formalism for interpreting the ground-state and excited state spin wave results. That work illustrates an important characteristic of his career—that he was equally at home with experiments and complex theory.

As part of the early work on magnetic compounds, Koon, John Schelleng (NRL) and I (then with NSWC) performed extensive low-temperature measurements of the magnetic properties of rapidly quenched amorphous alloys of (rare earth) Fe_2 composition to examine the unusual temperature dependence of the coercive fields and the relationship of that dependence to the random magnetic anisotropy and its effect on the formation of microdomains. Those large coercive fields in turn prompted Koon to consider ways in which the low-temperature phenomena could be extended to temperatures of technological interest. Along with Badri Das, he soon discovered the outstanding permanent magnet properties of the rapidly quenched alloy $(Fe_{0.8}B_{0.2})Tb_{0.05}$ that resulted from a specific heat treatment. Their work led to their receiving a patent, the Federal Laboratory Consortium Award for Excellence in Technology Transfer and to a share of the 1986 APS Prize for New Materials.

Koon's intense interest in physical phenomena was contagious and was the catalyst for the productive and long-term collaborations outlined above. As one of those collaborators, I appreciated his patience in explaining concepts and learned a lot from his keen insight. He had a knack for conveying complex ideas that made them relevant and understandable.

Most recently, Koon had turned his attention to the exchange interactions in giant magnetoresistive thin film alloy systems. He developed a micromagnetic theory of exchange coupling between antiferromagnetic and ferromagnetic layers that correctly predicted the 90° angle between spin directions in the two layers. By extending the model, he could also explain the positive exchange-bias behavior observed in specific layered systems.

Koon's many innovative contributions earned him an international reputation as an expert on the magnetism of rare earth elements and on permanent magnetic materials. He also served the magnetism scientific community as an editor of the *Magnetism Conference Proceedings* (published in the *Journal of Applied Physics*) and as an organizing committee member for the conference and other workshops and international meetings.

Koon will be long remembered for his seminal role in providing the definitive insight into a number of previously baffling theoretical and experimental problems in rare earth magnetism. His death is a significant loss to the scientific community, and he will be greatly missed by his friends and colleagues at NRL and elsewhere.

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Frederick Lobkowicz

FREDERICK LOBKOWICZ

Frederick Lobkowicz, a professor of physics at the University of Rochester, died on 3 February 1998, following complications from a heart attack. An exceptionally versatile scientist, Fred was best known for his contributions to high-energy physics.

Born in Prague, Czechoslovakia, on 17 November 1932, Fred belonged to one of that country's noble families, whose roots in Prague and Vienna date back centuries. He received his physics diploma in 1955 at the Swiss Federal Institute of Technology in Zurich, where he also received his PhD in nuclear physics under the direction of Pierre Marmier.

In 1960, Fred moved to Rochester to work at the university's 130-inch cyclotron. Among his first achievements was his involvement with John Tinlot and Dan Green in the first design of a 10 GeV muon storage ring.

Fred's scientific interests went beyond physics and spanned a huge intellectual panorama that embraced formal mathematics, phenomenology of particle and nuclear physics, electronics, mechanical design and cryogenic engineering. He worked on backward hadron scattering at Brookhaven National Laboratory in the mid to late 1960s, and, when Cornell University's 10 GeV synchrotron became operational, he and Ed Thorndike started an intense effort in photoproduction studies in the late 1960s to mid 1970s.

Starting in 1976, Fred's main research interests were focused at Fermilab, where he and his collaborators constructed two large calorimeters for studing radiative widths of mesons and direct-photon production. In fact, Fred was the first to introduce liquid argon calorimetry at Fermilab. More recently, he contributed to the D0 experiment at the Fermilab Tevatron and applied his expertise in calorimetry to designing the complex cryostat that will house the barrel section of the liquid argon calorimeter that is being developed for the ATLAS experiment at CERN's Large Hadron Collider.

During his 38 years at Rochester, Fred guided many excellent students and postdoctoral fellows, who benefited enormously from his breadth of interests and his style of doing research. Fred also wrote with Adrian Melissinos a rigorous two-volume text on introductory physics entitled *Physics for Scientists and Engineers* (W. B. Saunders, 1975), and he served as chair of the university faculty senate.

With many interests outside physics, Fred was well versed in history, mathematics and philosophy. But he enjoyed physics most of all, was always quick to get to the core of any issue and delivered his persuasive arguments in an unforgettably booming voice and direct manner. His style and contributions will be missed by all of us.

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