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Randolph A. Nanna, Publisher

achievement of diffraction-limited resolution in the UV.

Al was a Quaker and had a passionate interest in science education. In 1951 he combined the two when he went to Iraq for a year under the auspices of the UN Educational, Scientific and Cultural Organization (UNESCO) to help establish the departments of physics, chemistry, and biology at Baghdad University. With his wife, Joan, he coauthored the book *A Year in Baghdad* (J. Daniels, 1988), which recalls the challenges of raising three daughters in a startlingly different environment.

In 1956 Al returned to Stanford, where he began working with MIT physics professor Jerrold Zacharias, who had formed the Physics Science Study Committee. The PSSC was an effort to reshape the way physics was taught in high schools. In 1958 Al moved his family to Cambridge, Massachusetts, and began working at the Smithsonian Astrophysical Laboratory.

From 1961 to 1967, Al was the first head of the division of science teaching at UNESCO in Paris, where he helped develop projects in the basic sciences in Asia, Africa, Latin America, and the Arab states. He made a series of almost 100 films on physics principles for the *Encyclopedia Britannica* Educational Corporation from 1967 to 1974. He wrote an undergraduate physics textbook, *The New College Physics: A Spiral Approach* (W. H. Freeman, 1967). Additionally, he was a chairman of the commission on the teaching of science for the International Council of Scientific Unions and of the commission on education for the International Union for Conservation of Nature and Natural Resources.

Al liked to tell how surprised he was when, as he was registering for a physics conference in Geneva, Switzerland, in 1963, he was asked, “Are you the father of [folksinger] Joan Baez?” His daughter had just been on the cover of *Time* magazine. From then on, it was often the first question he was asked—even at physics conferences.

A lifelong pacifist, Al opposed both the nuclear weapons buildup of the 1950s and, later, the Vietnam War; he worked with many peace and humanitarian programs. After his retirement, he served as president of *Vivamos Mejor North America* (Let Us Live Better), which strives to improve the quality of life in Latin America through science-based education and community development projects.

When Al gave talks to students, he often mentioned the importance of the 3 Cs—curiosity, creativity, and compas-

sion. His many friends felt that he embodied those qualities, and we miss his stimulating ideas and gentle ways.

Al Thompson
Berkeley, California
George Castro
San José State University
San José, California

Horace Richard Crane

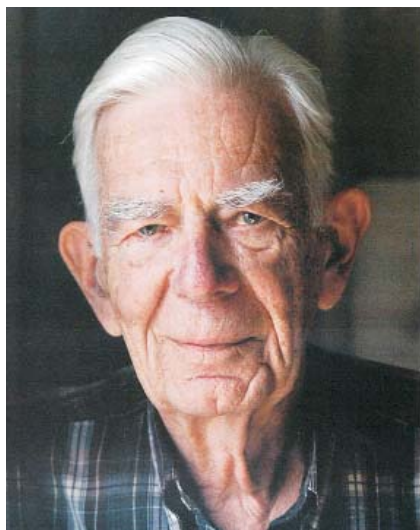
Experimental physicist H. Richard “Dick” Crane, who was the first to measure the magnetic moment of free electrons, died of age-related complications in Chelsea, Michigan, on 19 April 2007, just months short of his 100th birthday.

Born on 4 November 1907, Crane was raised in Turlock, a small farming town in central California. His parents encouraged their young son’s fascination with technology by letting him experiment with mechanical and electrical devices around the house. By age 14 he was licensed for amateur radio, an interest that lasted the rest of his life.

In 1926 Crane enrolled as a freshman at Caltech; when he graduated in 1930, jobs were hard to find, so he returned to Caltech for graduate school. He joined Charles Lauritsen’s group as a graduate assistant and helped build an accelerator used for studies of nuclear properties and for neutron production. Crane also tried to find evidence for the existence of the neutrino. By age 28 he had finished his thesis and done a year of postdoctoral work and had already been lead author on 17 letters and articles in *Physical Review*.

In 1935 Harrison Randall at the University of Michigan found the money to hire the bright Californian as an instructor. On arriving in Ann Arbor, Crane began building a 1-MeV accelerator and also undertook experiments with radioactive sources. Over the years 1936–40, he continued the study of nuclear disintegration, gamma and beta spectra, and mechanisms of electron energy loss.

He also continued to search for the neutrino. In 1938 he and Jules Halpern published the first convincing quantitative measurements of neutrino momentum. And in 1939 Crane searched for neutrino absorption by burying a radioactive source in a bag of salt and looking for sulfur produced by the inverse beta decay of chlorine; he was able to set an upper limit for the cross section of the process, and he also discussed the astrophysical implications of his result. Crane’s last publication on neutrinos, in *Reviews of Modern Physics* in 1948, re-



Horace Richard Crane

ceived lavish credit from Ray Davis in his 2002 Nobel Prize acceptance speech.

During World War II, Crane worked on the development of the proximity fuse at the Carnegie Institution, the Johns Hopkins University Applied Physics Laboratory, and Ann Arbor. He also worked briefly at the MIT Radiation Laboratory and on the Manhattan Project.

After the war Crane expanded his research beyond pure nuclear physics. In 1946 he proposed and then built an 80-MeV electron synchrotron shaped like a racetrack that featured long straight-line sections of beam path suitable for placement of injectors, targets, and detectors. The synchrotron became operational in 1952 and served as the model for many accelerators built at other institutions.

The synchrotron's electron injector was available before the rest of the accelerator was ready, so graduate student William Louisell applied it to Mott scattering, in which a magnetic field was used to guide electrons between the polarizer and analyzer. Crane realized that measuring the polarization's dependence on magnetic field could provide an accurate value for the magnetic moment of the free electron; this "g - 2" experiment was a way to refute the then widely held belief, based on the uncertainty principle, that this quantity was not susceptible to meaningful measurement. The first Michigan results drew much attention when they were reported in 1953, and for the next decade Crane continued to improve the experiment with the help of Robert Pidd, Arthur Schupp, David Wilkinson, Arthur Rich, and John Wesley.

In the mid-1950s, with the success of his experimental programs established, Crane stepped more visibly into national leadership roles. He was president of the Midwest Universities Research Associa-

tion from 1957 to 1960. In 1965 he was named to the National Academy of Sciences (NAS) and served on many of its committees. From 1965 to 1972, he was chair of the University of Michigan physics department. And from 1971 to 1975, he chaired the Board of Governors of the American Institute of Physics.

In the 1960s Crane began to devote more time to the improvement of teaching at the university level. This led to his serving as president of the American Association of Physics Teachers (AAPT) in 1965-66 and to his subsequent vice presidency of the Commission on College Physics in 1967-70.

Crane took uncommon pleasure in sharing his understandings with others. His ability to combine visual reasoning with formal calculation is nicely demonstrated in his expository papers on the principles of biological growth and in his 1956 analysis with Cyrus Levinthal on the unwinding of DNA. He returned to his love of tabletop experiments with a model to demonstrate geomagnetic field reversals. He showed how one could build a very short Foucault pendulum. And for many years, his column "How Things Work" appeared in *The Physics Teacher*; 70 of those columns are collected in a best-selling AAPT book of the same name.

Having already accomplished much for the teaching of college physics by the mid-1970s, Crane started to direct more of his interest and resources to science education for K-12 schoolchildren and for community-college students. He was also a driving force and leading developer of exhibits for the Ann Arbor Hands-On Museum.

Combining relentless curiosity and quiet intensity with an astonishing intuition for physics, Crane was still a modest, reserved man who often described himself as a tinkerer. But the appreciation of his colleagues was clearly expressed: In addition to his election to the NAS, his many honors included the American Physical Society's Davisson-Germer Prize in 1967, AAPT's Oersted Medal in 1977, and the National Medal of Science in 1986.

In his later years, Crane often spoke of having enjoyed a long life in an era when there was so much to discover. He had time to work in many fields of science, but he also had time to play the violin, go fishing, raise orchids, paint, and enjoy friends and family. An icon of Michigan physics, Dick Crane showed his many friends and colleagues how a balanced life in science could be lived.

Jens Zorn

University of Michigan
Ann Arbor ■

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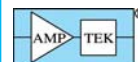
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