FREEMAN RECEIVES FIRST IUPAP MAGNETISM AWARD

Arthur Freeman, Morrison Professor of Physics at Northwestern University, is the first recipient of the International Union of Pure and Applied Physics Award in Magnetism. Sergei Vonsovsky of the Institute of Metal Physics in Sverdlovsk, Russia, presented Freeman with the award during a ceremony at the International Conference on Magnetism held in Edinburgh, Scotland, in September 1991.

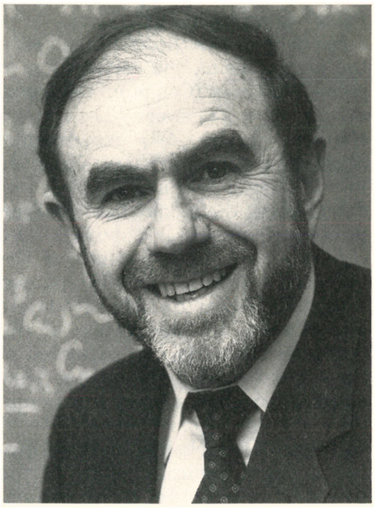
The new award is given triennially for contributions to fundamental or applied magnetism, and the winner is chosen by an award committee of the IUPAP Commission on Magnetism. The award consists of a small cash prize and a model of a hysteresis loop set in magnetite.

Freeman's award recognizes his research on magnetism of surfaces, interfaces, monolayers, ultrathin films, sandwiches and modulated structures. Using Freeman's full-potential linearized augmented plane-wave method in the context of density functional theory, Freeman and his coworkers came up with descriptions of the properties of electrons in low-dimensional systems. They predicted in the early 1980s that magnetism at transition metal surfaces would be strongly enhanced over that in the bulk: 40% greater than in bulk for Fe(001) and 300% greater for Cr(001). Experiments done by a group at the University of California, Berkeley, confirmed Freeman's predictions.

Freeman was also a pioneer in the field of monolayer magnetism. He found that a monolayer of chromium on Au(001) should have a 500% larger moment than in the bulk and that vanadium, which is not magnetic in the bulk or at its surface, becomes antiferromagnetic with a large moment when in a monolayer. These predictions stimulated experimenters to search for evidence of such unexpected phenomena.

Freeman earned his PhD in physics at MIT with John C. Slater in 1956. From then until 1962 he worked at the US Army Materials Research Agency in Watertown, Massachusetts. For the five years after that he was head of the theoretical physics group and associate director of the Francis Bitter National Magnet Lab at MIT. Since 1967 he has been a professor in Northwestern's physics department; he was chairman of the department from 1967 to 1972.

Arthur Freeman



OBITUARIES

Robert Hofstadter

Robert Hofstadter, professor of physics at Stanford University, died at his home on 17 November 1990 at the age of 75. His death was due to a heart attack and followed a lengthy battle with heart disease.

Hofstadter was born in New York City in 1915. He graduated from the City College of New York in 1935 with a BS degree. From 1935 to 1938 he was a graduate student in physics at Princeton University, where he received both his MA and PhD degrees. In his graduate work he concentrated on the infrared spectra of simple organic molecules and, in particular, on the elucidation of the structure in formic acid now known as the hydrogen bond. He stayed at Princeton in 1939 as a postdoctoral fellow, beginning in this period what would be a lifelong interest in solid-state studies in luminescence and in photoconductivity. The following year, at the University of Pennsylvania, Hofstadter helped construct a large Van de Graaff generator. He also began studying nuclear physics and thought about the particle detectors that would be necessary for any experimentation in nuclear physics.

Robert Hofstadter

The advent of World War II interrupted these studies. During the war Hofstadter worked at the National Bureau of Standards on proximity fuses. Later he worked at the Norden Laboratory Corporation on servo systems, automatic pilots for aircraft and radio altimeter devices.

In 1946 Hofstadter returned to Princeton as an assistant professor of physics, and he began serious studies of nuclear processes and particle detectors. These studies included work on the Compton effect, crystal conduction counters, scintillation counters, and the detection and measurement of gamma rays and their energies. In 1948 Hofstadter made the important discovery that thallium-activated sodium iodide, NaI(Tl), made an excellent scintillation counter, and in 1950, with John A. McIntyre, he showed how NaI(Tl) could be used as a spectrometer for measuring gamma ray energies. This crucial discovery by Hofstadter had far-reaching effects: The material has been in universal use as a gamma-ray spectrometer ever since, yielding important contributions to all branches of nuclear and high-energy physics and to astrophysics, as well as to medicine, biology, chemistry, geology and other fields. The material had such widespread use in spite of the fact that it is expensive and difficult to work with. In later years Hofstadter was to look back on his discovery of the linearity of response and high light output of NaI(Tl) as the most important contribution he made to science, in terms of its impact on a variety of fields.

In 1950 Hofstadter joined the faculty of Stanford at the urging of Felix Bloch and of Leonard Schiff, whom he had known earlier at Pennsylvania. He immediately embarked on a program to study elastic and inelastic scattering of high-energy electrons by nuclei using the Mark III linear electron accelerator at the High Energy Physics Laboratory. At first, when the Mark III was still under construction, the research was limited to a top energy of 200 MeV, but eventually the maximum energy reached its design value of 1 GeV. Hofstadter employed a type of magnetic spectrometer that was double-focusing (or point-to-point focusing) and built in a 180° configuration. As a result the spectrometers were quite large for the time: The largest one had a radius of curvature of 72 inches, was capable of analyzing 1-GeV/c electrons and weighed 140 tons.

These electron scattering studies, which continued over the next 20 years, explained how electric charge (and magnetism) is spread out within the volume of a nucleus, and they were extended to include the proton and the neutron as well. Even the neutron, which is overall electrically neutral, has a distribution of charge and magnetism within it. For the first time the proton and the neutron were shown to be nonpoint particles that therefore possessed structure—that is, they were somehow made up of other particles. He collected a number of the seminal papers in the field in an excellent book: *Electron Scattering and Nuclear and Nucleon Structure* (W. A. Benjamin, New York, 1963). For his extensive work in nuclear structure studies using the method of elastic and inelastic electron scattering, Hofstadter was awarded the Nobel Prize in Physics in 1961.

After 1968 Hofstadter and his colleague E. Barrie Hughes developed new detectors for high-energy physics. The "Crystal Ball," developed at Stanford and SLAC, was one outcome of this research. The Crystal Ball was a spherical array of over 900 sodium iodide detectors, all pointed at the common region where an electron beam collided with an opposing positron beam. This device uncovered fundamental new results in the spectrometry of new mesons containing charmed and bottom quarks. In 1970 Hofstadter introduced the idea of placing a large, high-energy gamma-ray detector on a satellite in Earth orbit to do gamma-ray astronomy—a field then in its infancy. Much of his effort in the last decade was devoted to helping design, build and test the Energetic Gamma Ray Experiment Telescope, one of the four instruments on board NASA's Gamma Ray Observatory. EGRET is sensitive to the highest-energy gamma rays, from roughly 20 MeV to 130 GeV. It uses electron–positron pair production in thin tantalum foils as the detection mechanism. The produced pair triggers plastic scintillators that, in turn, pulse on a set of digital spark chambers to image the pair trajectories. At the same time, energy analysis is accomplished by an array of NaI(Tl) scintillation crystals. GRO was successfully launched in April 1991, only a few months after Hofstadter's death.

Hofstadter had a lifelong interest in new applications of gamma-ray detectors to problems in medical physics. The early use of his sodium iodide detectors in the Auger camera was perhaps the first such example. The latest example was his idea that the intense, tunable synchrotron radiation produced at electron storage rings would provide a source of x rays uniquely suited to measuring the K edge of the iodine dyes used in coronary angiography. The first experiments on this concept were carried out at the SPEAR electron storage ring at the Stanford Linear Accelerator Center in 1980. The approach is based on the principle of iodine dichromography, in which two monochromatic x-ray beams, closely bracketing the K edge of iodine (33.17 keV), are used to acquire line-scan images.

At Stanford Hofstadter was appointed the Max H. Stein Professor of Physics in 1971, directed the High Energy Physics Laboratory (1967–72) and served on the Senate of the Academic Council (1971–72 and 1981–83). He retired in 1985 but was recalled to active duty every year after that until his death. He was an ardent supporter of Stanford athletic teams, and he enjoyed listening to music and spending time with his family on his ranch in northern California.

Hofstadter often taught introductory physics courses, and he was praised by students for the clarity of his lectures. He also used his simple teaching style effectively in upper division courses. His graduate students invariably found him to be helpful and caring. He was always concerned about his students' welfare, and they usually thought of him as a friend in addition to his role as their mentor.

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Dmitri V. Skobeltsyn

Academician Dmitri Vladimirovich Skobeltsyn, a prominent physicist of the 20th century and a pioneer of high-energy physics, died on 16 November 1990 in Moscow.

Skobeltsyn was born on 24 November 1892 in St. Petersburg, the son of a professor at the St. Petersburg Polytechnic Institute. After graduating from St. Petersburg University, he devoted himself to the pedagogical and scientific activities going on within the walls of the university and the polytechnic institute. In 1925 Skobeltsyn became a research fellow of the Leningrad Physicotechnical Institute.

His first experiments in Leningrad in 1923 were inspired by the discovery of the Compton effect. He continued them at Marie Curie's laboratory in Paris beginning in 1927.

Skobeltsyn was the first to advance the idea of using the registration of recoil electrons (Compton electrons) arising in a gas-filled Wilson cloud chamber. In his 1927 experiments, Skobeltsyn placed a Wilson chamber in a magnetic field and succeeded in determining the momenta of charged particles passing through the chamber. His investigations of the Compton effect of radium gamma rays enabled him to verify adequately and directly, by observation of the Compton electrons, the existence of the gamma quantum momenta. That observation contradicted the Compton and Dirac theories but agreed well with the Klein-Nishina-Tamm theory—the first rigorous result of the new field of quantum electrodynam-