

IN BRIEF

The Spectroscopy Society of Pittsburgh has announced that **Alan G. Marshall** will receive the 2002 Pittsburgh Spectroscopy Award at the society's annual conference in New Orleans, Louisiana, next March. Marshall is being recognized for his "co-invention (with Melvin Comisarow) of the Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) technique and other advancements he has stimulated in mass spectrometry." He is the Kasha Professor of Chemistry at Florida State University and director of the ion cyclotron resonance program at the National High Magnetic Field Laboratory in Tallahassee, Florida.

At its annual meeting held this month in Atlantic City, New Jersey, the Eastern Analytical Symposium presented the 2001 EAS awards to seven individuals, two of whom conduct physics-related work. **Ray Freeman** received the EAS Award for Achievements in Magnetic Resonance. He retired in 1999 as the Plummer Professor of Magnetic Resonance in the chemistry department at the University of Cambridge in the UK and is currently writing an introductory book on magnetic resonance. The EAS Award for Achievements in Near-Infrared Spectroscopy was given to **Yukihiro Ozaki**, a professor of chemistry at Kwansei-Gakuin University in Nishinomiya, Japan.

The Commission on Cosmic Rays of the International Union of Pure and Applied Physics handed out its awards for 2001 in August at the International Cosmic Ray Conference in Hamburg, Germany. The Shakti P. Duggal Award went to **Teresa Montaruli** in recognition of "significant contributions to cosmic-ray physics by a young scientist of outstanding ability." Montaruli is an associate researcher with a joint appointment at Bari University and the National Institute of Nuclear Physics (INFN), both in Italy. **Vitaly Lazarevich Ginzburg** received the O'Ceallaigh Medal for "outstanding contributions to cosmic-ray physics." He is a scientific adviser at the Lebedev Physical Institute in Moscow and a professor at the Moscow Physics and Technology Institute. **Reuven Ramaty** was acknowledged with the Yodh Prize for "significant and outstanding contributions to the field of cosmic-ray astrophysics." A senior scientist at

NASA's Goddard Space Flight Center in Greenbelt, Maryland, he was informed of this honor shortly before his death this past April.

This past July, **Gordon E. Pike** was appointed editor-in-chief of the *Journal of Materials Research*. He is concurrently working as a senior manager at Sandia National Laboratories in Albuquerque, New Mexico. He replaces **Robert P. Frankenthal**, who retired from the journal after three years as its editor-in-chief. Frankenthal continues to work as a consultant, primarily to Bell Labs, Lucent Technologies, in Murray Hill, New Jersey.

Royce Zia won an Alexander von Humboldt Research Award this year from the Alexander von Humboldt Foundation in Bonn, Germany. He is a professor of physics and codirector of the Center for Stochastic Processes in Science and Engineering at Virginia Tech in Blacksburg, Virginia. The foundation acknowledged Zia for his "seminal contributions to the theory of critical and interfacial phenomena," adding that he "has played a pioneering role in recent years in advancing our understanding of the statistical mechanics of nonequilibrium systems, in particular, driven diffusive systems." The award recognizes past accomplishments of winners, who are invited to carry out research projects of their choice in Germany. Zia will conduct his research at the University of Essen with Hans Werner Diehl.

Beverly Karplus Hartline joined Argonne National Laboratory last April as deputy director. She previously was the acting deputy associate laboratory director of the strategic and supporting research directorate at Los Alamos National Laboratory.

The International Centre for Diffraction Data, located in Newtown Square, Pennsylvania, presented the 2001 J. D. Hanawalt Award in August to **Raymond P. Goehner** and **Joseph R. Michael**, both of Sandia National Laboratories in Albuquerque, New Mexico, for "excellence in the field of x-ray powder diffraction." After receiving the award, Goehner, manager in the materials characterization department, and Michael, distinguished member of the technical staff, both presented the Hanawalt Award Lecture entitled "Phase Identification Using Electron Backscatter Diffraction in the SEM [Scanning Electron Microscope]: A Powerful Tool for Materials Science" at the annual Denver x-ray conference in Steamboat Springs, Colorado.

Earlier this year, **Lyle Schwartz** became the new director of the Air Force Office of Scientific Research, headquartered in Arlington, Virginia. Schwartz, previously the director of the aerospace and materials sciences directorate at that office, replaced **Joseph F. Janni**, who retired in March after five years as director. Janni plans to work as a research consultant in the science community.

OBITUARIES

Clifford Glenwood Shull

Clifford Glenwood Shull, a 1994 Nobel Prize winner in physics for his pioneering work in neutron scattering, died of kidney failure on 31 March 2001 in Lexington, Massachusetts.

Born in Pittsburgh, Pennsylvania, on 23 September 1915, Cliff enrolled at Carnegie Tech (now Carnegie Mellon University) in Pittsburgh to study aeronautical engineering. Influenced by Emerson Pugh, he switched to physics after his freshman year, earning a BS in physics in 1937. He then went on to graduate school at New York University, where he received a PhD in nuclear physics in 1941. His thesis at NYU, under Frank Myers, involved the construction of a Van de Graaf accelerator and the scattering

of polarized electrons.

During the time Cliff was working on his thesis, exciting things were happening at NYU involving the theory of neutron scattering from magnetic materials and the initial experimental efforts in the magnetic scattering of neutrons. In 1939, Otto Halpern and Montgomery Johnson of NYU published their definitive paper on the magnetic scattering of neutrons. At the same time, Martin Whitaker of NYU was using this theory in experimental attempts to measure the neutron magnetic moment using polychromatic neutrons from a radium-beryllium source. Cliff would later play a critical role in establishing the correctness of the Halpern and Johnson theory and in exploiting this theory in a series of brilliant experiments that opened the entire field of

magnetic structures to experimental study using various neutron scattering techniques. Whitaker would later play a role in bringing Cliff to Oak Ridge National Laboratory and to his destiny with neutrons.

After he finished his thesis in June 1941, Cliff accepted a job with the Texas Co (later to become Texaco) in Beacon, New York, where he studied and characterized catalysts used in making high-octane aviation fuel. He used x-ray diffraction and small-angle scattering techniques to study powder samples; those techniques gave him valuable experience for his later work with neutrons.

After the Manhattan Project was initiated during World War II, Cliff's friends and mentors from NYU urged him to join the University of Chicago's Metallurgical Laboratory, being organized by Arthur Compton. Cliff wanted to do this, but the Texas Co convinced the War Manpower Board that Cliff's work was critical to the war effort, and so he stayed at Beacon for the duration of the war.

After the war ended, Cliff was released from Texaco and was free to seek employment in the new fields created by the wartime work on fission. He contacted Whitaker, the first director of the Clinton Laboratories, which was then a part of the Manhattan Project and would soon become the Oak Ridge National Laboratory. On a visit to Oak Ridge in 1946, Cliff met Ernie Wollan and learned of Wollan's exploratory work on the diffraction of monochromatic neutrons by powder samples of sodium chloride and scattering of neutrons by water and heavy water. Cliff was immediately excited by this work and came to Oak Ridge in June 1946.

Wollan had been a student of Compton's at the University of Chicago and was well versed in the theory and practice of x-ray diffraction. When Shull arrived, Wollan had already assembled a two-axis neutron diffractometer, using a large NaCl crystal as a monochromator along with the Compton-designed sample table and counter arm that Wollan had used in his thesis work at the University of Chicago. At first, they concentrated on developing a complete understanding of the scattering of neutrons by powder samples. They then used this powder diffraction technique to measure the neutron coherent scattering amplitudes of almost all the elements and many isotopes. For years, this work served as reference data for interpreting all neutron scattering experiments.



CLIFFORD GLENWOOD SHULL

Early in this work of building a library of neutron scattering amplitudes, Shull and Wollan determined the hydrogen and deuterium amplitudes (both fairly large and opposite in sign) by measuring the diffraction patterns of sodium hydride and sodium deuteride. By combining the hydrogen result with the known total cross section, they deduced the nuclear singlet and triplet scattering amplitudes and explained the large total cross section in terms of nuclear spin incoherent scattering. They used the deuterium result in a study of the structure of ice that gave the first direct evidence in support of Linus Pauling's double minimum potential model of hydrogen bonding. Varying the coherent neutron scattering amplitude of hydrogen by controlled deuteration is now one of the most powerful techniques available in the study of polymers and biological materials.

It was the study of magnetic materials that most excited Shull and Wollan. They had the theory of Halpern and Johnson, the first neutron source capable of producing sufficient flux, and the right experimental technique—powder diffraction. They quickly exploited these factors in a series of experiments that established neutron scattering as the key to understanding magnetic materials. The first direct evidence of antiferromagnetism came from determining the magnetic structure of manganese oxide. In addition, the Néel model of ferrimagnetism was confirmed for magnetite (Fe_3O_4); the first magnetic form factor data were obtained by measuring the paramagnetic scattering by Mn compounds; the production of polarized neutrons by Bragg reflec-

tion from ferromagnets was demonstrated; the magnetic diffuse scattering was used to determine the distribution of magnetic moments in 3d alloys; and the magnetic critical scattering at the Curie point of iron was measured. For his work on magnetic materials, Cliff was awarded the Buckley Prize by the American Physical Society in 1956.

Attracted by a new research reactor being constructed at MIT and by the opportunity to teach, Cliff joined MIT in 1955 as a professor of physics; he remained there until his retirement in 1986. His first experimental work at MIT involved constructing and using a highly sensitive polarized neutron diffractometer to make extensive and precise measurements of the magnetic form factor in Fe. That work revealed the spatial variation of the spin density and the existence of negative spin density in regions of the unit cell far removed from the Fe sites.

In the 1960s, Cliff studied dynamical diffraction and the propagation of neutron waves in perfect crystals. That work, which required imaginative experimental concepts, careful attention to experimental details, and thorough understanding of theory, was ideally suited to Cliff's character; he remained active in this field until his retirement.

Cliff loved experimental work and typically had an experiment in progress, usually in collaboration with a postdoc student. His success as an educator can be measured by the distinguished careers of many of his graduate students. The MIT physics community held Cliff in high regard as an inspiring colleague, always kind and generous, who maintained high academic standards and high scientific productivity. Early in his career at MIT he developed several neutron experiments for undergraduate physics students using his equipment at the reactor. He took great pleasure in this program, which continued until his retirement. He was elected to the National Academy of Sciences in 1975.

Cliff was modest and unpretentious with regard to his accomplishments, gentle in his interaction with others (including students), always willing to help by sharing his knowledge and experience, and careful to give credit to others. These qualities resulted in universal admiration, respect, and affection for Cliff within the neutron scattering community. In honor of his accomplishments, Cliff's sons endowed the Cliff Shull Scholarship Fund for undergraduate physics students at

Carnegie Mellon University. Cliff was a much-loved father of his field.

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Louis Néel

Louis Néel, an impressive figure in the French scientific scene after World War II, who received the Nobel Prize in 1970 for research in magnetism, died of a stroke in Brive-la-Gaillarde, France, on 17 November 2000.

Born in Lyon, France, on 22 November 1904, Néel obtained, in 1928, the first rank in the *Agrégation de Physique* at the Ecole Normale Supérieure (Paris). He then went directly to Strasbourg to prepare a thesis in the laboratory of Pierre Weiss. His thesis was entitled “The Effects of Magnetic Fluctuations of a Molecular Field on the Magnetic Properties of Objects” (1932).

Néel was indeed a worthy successor to the French tradition of research in magnetism initiated by Pierre Curie, Paul Langevin, and Pierre Weiss. But he is better known in France as the one who developed Grenoble into a major international center of research after the war. With a large center for nuclear energy, a laboratory for semiconductor developments, two international instruments that use synchrotron radiation and neutrons, and the many university and CNRS (French National Center for Scientific Research) laboratories he developed, Néel profoundly changed, in only 20 years, the atmosphere of a provincial town with good industrial activities but poor research facilities before and during World War II.

Néel’s successes in research and scientific administration were helped by circumstances; they came mostly from a clear awareness of his aims and possible limitations, and were stimulated by a great willpower. His sharp mind concentrated on scientific models of his own, simple enough to be developed on the back of an envelope, but powerful because they were well adapted to the problems at hand and general in nature. His greatest successes came against the stream of fashion. He published to the last in French; his work during the war was poorly published and thus hardly known.

In committees, he was a massive and impressive chairman, awake in daylong sessions to the last minute, when he often tried to realize his dearest wishes in the general tiredness. He liked lively discussions, how-

ever, and only respected determined opponents. Despite many honors and connections worldwide, Néel kept a quiet and happy family life with his wife, a teacher in philosophy, and their three children.

Néel’s research centered on the arrangements of the magnetic moments in solids, at atomic and larger scales. In Weiss’s laboratory in Strasbourg, Néel questioned the accepted Curie–Weiss law for susceptibility, which had been deduced from distance-independent interactions. Werner Heisenberg’s work on exchange had just shown that short-range effects should be expected. Between 1931 and 1933, Néel observed those effects in the susceptibility of iron and alloys and in the specific heat of nickel. Then, assuming that short-range interactions could be antiparallel, Néel developed the concept of antiferromagnetism, in which two interpenetrating atomic lattices are treated in a molecular field approximation. Manganese and chromium showed the predicted susceptibility, with a peak at what became known as the Néel temperature. These proposals, made in 1936, were confirmed in 1938 on manganese oxide, an insulator with no possible contributions from metallic paramagnetism.

To describe antiferromagnetism, Lev Landau and Cornelis Gorter suggested quantum fluctuations to mix Néel’s solution with that obtained by reversal of moments. But in a macroscopic crystal with magnetocrystalline anisotropy, the nucleation would involve a magnetic wall of high energy. Using neutron diffraction, Harry Shull confirmed (in 1950) Néel’s model.

This model had been extended in 1947 to describe ferrimagnetism of spinel ferrites: Néel assumed that the atoms of the two lattices have different moments. In 1956, rare earth garnets were discovered in Grenoble, where the ferrimagnetism of Fe ions is coupled to the rare earths. This flexible family led to hard (noncubic) magnets and to soft and lossless (cubic) ones. At a dinner held to celebrate Néel’s receipt of the Nobel Prize, his friend Hendrik Casimir stressed that these contributions were essential to Philips research laboratories’ development of ferrite-based devices. Bell Laboratories and Japanese firms could have made similar statements.

Applications were at the root of Néel’s work, which looked at larger scales. His interest in hysteresis dated from the war: Indeed, he personally supervised the magnetic protection of all main vessels of the



LOUIS NÉEL

French navy, during the spring of 1940, from magnetic mines by applying a short strong field, opposite in direction to Earth’s, thus reducing the ships’ magnetization due to Earth’s field. Hysteresis in polycrystals or with diffusing impurities came to be of central interest in Grenoble, where Néel took refuge in 1940.

During the war, Néel developed reasonably hard magnets by compressing soft Fe powders. When smaller than the thickness of Bloch walls, each grain is a single domain; at low temperatures, its form factor blocks its magnetization along a specific axis. Cooling under an applied field produces a stable remanant magnetization. This model was later applied to hard cobalt–nickel steels and to ceramics and basalts cooled down under the influence of Earth’s field. Néel was proud of this last work, which opened the possibility of relating the continental drift to the rate of reversal of Earth’s field.

During or just after the war, Néel predicted the main features observed later in magnetic configurations near various surfaces, notably in thin sheets. In thin sheets that lack large magnetocrystalline effects, he pointed out that magnetization is parallel to the surfaces. In a “Néel wall” between domains in such sheets, magnetization rotates with an axis normal to the sheet; a singular line separates two parts of the wall that have opposite rotations, as indeed in a Bloch wall but with a different structure.

Néel was gifted with his hands and relaxed by making furniture. But, in Grenoble, his experiments were mostly done by collaborators, notably Louis Weil and Felix Lewy-Bertaut, two Jews protected during the war by