

1997 Bingham Medal at the annual meeting of the Society of Rheology, to be held this month in Ohio. According to the citation that accompanies the medal, Fuller is being honored for, among other things, his pioneering development of experimental techniques in optical rheometry and his studies of the physics of complex fluids, which sparked these techniques. Fuller and his research group at Stanford have "furthered our understanding [of] the conformation of flexible polymers in flow, alignment of rod-like polymers in flow, the structure of liquid crystal defect texture and the dynamics of miscible polymer blends," the citation stated.

The 1997 *Journal of Rheology* Publication Award will go to **Inge Vinckier**, **Paula Moldenaers** and **Jan Mewis** of the chemical engineering department at the Catholic University of Louvain in Belgium for their paper entitled "Relationship between Rheology and Morphology of Model Blends in Steady Shear Flow."

At the SoR meeting in Texas last February, **Arthur B. Metzner**, the H. Fletcher Brown Professor of Chemical Engineering Emeritus at the University of Delaware, received the Distinguished Service Award, which has only been given three other times. A former Bingham Medal recipient, Metzner was honored for his editorship of the *Journal of Rheology* and his leadership in SoR.

European Society Honors Geophysicists

At its 22nd general assembly in Vienna last April, the European Geophysical Society bestowed honorary membership on three researchers and gave awards and medals to seven others.

Two of EGS's new honorary members are **Paul J. Crutzen**, director of the atmospheric chemistry division of the Max Planck Institute for Chemistry in Mainz, Germany, and **Donald R. Nielsen**, who is an emeritus professor of soil and water science at the University of California, Davis. EGS also bestowed honorary membership on **Hubert H. Lamb**, who had retired from the Meteorological Office of the UK's Ministry of Defence, just a few months before his death on 28 June.

EGS gave Badge Awards for service to the society to **Antonello Provenzale** and **Richard A. Harrison**. Provenzale, who works at the National Research Council of Italy's Institute of Cosmo-Geophysics in Torino, was cited for his promotion of nonlinear processes in geophysics within EGS, and

Harrison, a scientific officer of the astrophysics division of the Rutherford Appleton Laboratory in the UK, was commended for his service as vice president of the solar-terrestrial sciences section and for his general contributions to EGS.

EGS presented the Louis Néel Medal to **Reinhard Boehler**, head of the high-pressure group at the Max Planck Institute for Chemistry in Mainz. He was praised for "his crucial studies of the phases and properties of materials at pressures and temperatures simulating conditions in the Earth's lower mantle and core."

Vlastislav Cervený received the Beno Gutenberg Medal "in recognition of his outstanding theoretical contributions to the field of seismology and seismic prospecting." Cervený is a professor at the Institute of Geophysics at Charles University in Prague in the Czech Republic.

Friedrich Schott was given the Fridtjof Nansen Medal for "his numerous and outstanding contributions to the study of the large-scale circulation of the oceans and for his process-oriented work which has significantly enlarged our knowledge of deep ocean convection." Schott is a professor at the Institute for Marine Research at the University of Kiel in Germany.

The Vilhelm Bjerknes Medal was given to **Brian J. Hoskins**, who is the head of the department of meteorology at the University of Reading in the UK. His citation noted his "outstanding contributions to the understanding of the dynamics of atmospheric fronts and extratropical cyclones." It also noted "his fundamental work in dynamic meteorology."

The Young Scientists' Publication Award went to **Wolf-Gerrit Früh** for his paper on "low order models of wave interactions in the transition to baroclinic chaos," which appeared in *Non-linear Processes in Geophysics*. Früh is in the departments of physics and astronomy at both the University of Glasgow and the University of Edinburgh in Scotland.

OBITUARIES

Chien-Shiung Wu

Chien-Shiung Wu died in New York City on 16 February 1997 at the age of 84, following a stroke. A leading experimental physicist in beta decay and allied fields, she leaves an admirable record of accomplishment, as well as many devoted friends, colleagues and students.

Wu was born in Liuhu, a small town

IN BRIEF

At the annual meeting of the American Association of Physicists in Medicine in July, **Paul Medin** of the University of California, Los Angeles, School of Medicine won the 1997 John R. Cameron Young Investigators Award. The other Young Investigators Award recipients were **Hui Helen Liu** of the Mayo Clinic and Foundation in Rochester, Minnesota, and **Ehsan Samei** of the Henry Ford Health System in Detroit and the University of Michigan in Ann Arbor.

Stanford S. Penner is the 1997 recipient of the Edward Teller Award for the Defense of Freedom, presented by the Doctors for Disaster Preparedness at their annual meeting in June. The award was for his work on hypersonic reentry, space propulsion and missile defense. Penner is an emeritus professor of engineering physics at the University of California, San Diego.

The American Institute of Aeronautics and Astronautics Foundation has given its 1997 Gordon C. Oates Air Breathing Propulsion Graduate Award to **Donald Freund**, a graduate student in aerospace engineering at the University of Cincinnati, for an experiment to simulate the effects of flying a supersonic jet aircraft into rapid, severe changes in the atmosphere.

Later this month, the Welch Foundation will present the Robert A. Welch Award in Chemistry, worth \$300 000, to **Ahmed Zewail**, the Linus Pauling Professor of Chemistry and a professor of physics at Caltech. Norman Hackerman, chairman of the foundation's Scientific Advisory Board, said, "Not only has Dr. Zewail greatly expanded our understanding of chemical reactions, but the fundamental nature of his work can be seen in biologists' and physicists' adoption of femtochemistry techniques."

near Shanghai. At that time in China, girls received their education at home, if at all. (The Chinese characters for Chien-Shiung translate to "strong hero" or "healthy male.") Her father, Wu Zhong-Yi, who opened one of the earliest schools admitting girls in China, encouraged her to go to Shanghai for a class taught by Hu Shi, a leading Chinese scholar who introduced the practice of writing Chinese

as it is spoken (called *bai hua*, meaning "plain language"), now universally used in China. Her talents recognized by Hu Shi, she went on to receive a BS degree in physics from National Central University in Nanjing in 1934, and then taught and worked in x-ray crystallography at the National Academy of Sciences, then in Shanghai. Intent upon continuing her education, she moved to the US in 1936, and earned her PhD in physics at the Berkeley campus of the University of California in 1940 for studies on the fission products of uranium.

After two years as a research assistant at Berkeley, she taught at Smith College and, briefly, at Princeton University before joining the Manhattan Project at Columbia University in 1944. Starting in 1946, she served in Columbia's physics department as research associate until 1952, as an associate professor until 1958, and then was appointed professor, retiring in 1981 as Michael I. Pupin Professor of Physics. She maintained a lively interest in physics long after her retirement.

In 1946, after working on radiation detectors at Columbia for the Manhattan Project, she concentrated her research on beta decay—a field in which many experimental results disagreed with one another and with Enrico Fermi's 1934 theory of the phenomenon. Her exquisite sense of experimental physics, great care for precision and reproducibility and systematic approach to obtaining thinner and thinner sources enabled her to complete with her colleagues a series of experiments that confirmed the Fermi theory of beta decay for allowed transitions. Their experiments also confirmed the predictions for the shapes of forbidden transitions. In that way, she showed herself to be a master of this field and of her profession.

Wu is best known for her role in testing parity conservation in beta decay, an experiment she recounted 27 years later in the short-lived journal *Adventures in Experimental Physics* (Gamma Volume, Bogdan Maglich, ed., World Science Education, Princeton, NJ, 1973). Warmly and very personally, Wu revealed both the science and her pleasure in the collaboration and discovery.

As she told the story, in early spring 1956, Tsung-Dao Lee and Chen-Ning Yang were exploring the possibility that a single particle (the τ - θ) might decay into states of both odd (3 pion) and even (2 pion) parity, leading them to question whether parity was truly conserved in the weak interaction. Nonconservation of parity might be demonstrated, they reasoned, by measuring a pseudoscalar quantity such as



CHIEN-SHIUNG WU

the product of the nuclear spin and the linear momentum of the electron in beta decay, averaged over all decays. This product should be zero (symmetric decay with respect to the spin axis) if parity is conserved, but nonzero otherwise. Wu suggested to Lee that instead of using either polarized nuclei produced during nuclear reactions or a polarized slow neutron beam from a reactor, "the best bet would be to use a ^{60}Co beta source polarized by adiabatic demagnetization, by which one could attain polarization as high as 65%." And at a time when there was no guarantee that parity nonconservation might be possible (in total violation of conventional wisdom), Wu dedicated herself to actually doing the experiment.

She and her husband Luke Chia-Liu Yuan, also a particle physicist, had planned to participate in a high-energy physics conference in Geneva and then go to China on a lecture tour that same year (1956). Wu "suddenly realized that I had to do the experiment immediately, before the rest of the physics community recognized the importance of this experiment and did it first." Luke Yuan was persuaded to go abroad without her.

Wu's group at Columbia and her intimate knowledge of beta decay gave her the confidence to overcome the problem of beta counting from a source at millikelvin temperature. On 4 June 1956, she called Ernest Ambler at the National Bureau of Standards (NBS), who enthusiastically accepted her proposition that the experiment be done at NBS using the bureau's expertise in nuclear orientation and equipment. Their manuscript submitted to

Physical Review on 15 January 1957 demonstrated near-maximal violation of parity conservation. It was published 40 years and one day before her death as "Experimental Test of Parity Conservation in Beta Decay" (*Physical Review*, volume 105, page 1413, 1957), with Ambler, Raymond Hayward, Dale Hoppes and Ralph Hudson of NBS as coauthors. Wu and the NBS group were thus the first to establish the nonconservation of parity and the violation of particle-antiparticle charge-conjugation symmetry in physics, forever altering our view of the universe.

Her 1963 work with Yung-Keun Lee and Luke Wei Mo on the observation of weak magnetism confirmed the symmetry between the weak and the electromagnetic currents, and set the cornerstone for the unification of those two basic forces into the electroweak force.

In the late 1960s, among other studies, Wu and her group, in collaboration with John Bertles, compared the Mössbauer effect in normal human hemoglobin (Hb-A) and in sickle cell hemoglobin (Hb-S), and showed that the local environment of the oxygen-binding sites in deoxygenated Hb-S was the same as in Hb-A, even though the conformational structures of Hb-S and Hb-A are different.

In the 1970s, Wu's research group was working on double beta decay, exotic atoms, Mössbauer-effect studies of hemoglobin, beta-asymmetry studies of nuclei polarized at ultralow temperatures, time-reversal invariance tests of the weak and electromagnetic interactions and magnetic transitions and magnetic relaxation effects in materials at ultralow temperatures.

Wu served as president of the American Physical Society (1975) and received the National Medal of Science (1975) and the Wolf Prize in Physics (1978).

For our late colleague Chien-Shiung Wu, the words of Einstein on the death of Marie Curie are apt: "Her strength, her purity of will, her objectivity, her incorruptible judgment, all these were of a kind seldom found joined in a single individual. Once she had recognized a certain way as the right one, she pursued it without compromise and with extreme tenacity." Wu was also a person of great humanity whose vivacity and concern endeared her to her many students and colleagues.

The world of physics benefited greatly from her life and contributions.

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