

A central theme in Symanzik's work over the last 15 years was extending the applicability of perturbation theory. His studies of the breaking of scale invariance by renormalization in quantum field theory led him (and independently Curt Callan) to the discovery of the Callan-Symanzik equation, which expresses renormalization group properties of the above-mentioned expectation values. It provided the impulse for the development of asymptotically free quantum field theory such as QCD and led to a resummation of perturbation theory, which makes it applicable to strong interactions of elementary particles at short distances. Symanzik also found a first model of an asymptotically free quantum field theory. His last activities were concerned with construction of improved lattice approximations for QCD, to enhance calculational capabilities. He remained as productive and innovative as ever until his untimely death.

For his colleagues in Hamburg, Symanzik's death is a grievous loss. While his papers were very difficult to read—he refused to publish anything that he would have considered trivial or repetitive—he was easy to communicate with and always ready to share his enormous treasure of knowledge.

GERHARD MACK
Universität Hamburg

John M. Wilcox

John Marsh Wilcox, Director of the Stanford Solar Observatory, died on 14 October 1983. He was 58 years old.

Wilcox specialized in the study of magnetic fields at the solar surface and in the interplanetary medium. He wrote or co-authored more than 100 articles on waves in laboratory plasmas, solar magnetism, solar oscillations, solar rotation, coronal and interplanetary magnetic fields, the solar wind, geomagnetic responses to the solar wind, and the influence of solar activity on terrestrial weather.

He did innovative studies of the global solar structure, including large-scale solar phenomena such as magnetic sectors and polar magnetic regions. Working with Norman Ness, he discovered that during times of moderate solar activity, the interplanetary medium is ordered into the large-scale magnetic structures he called sectors. Together with Robert Howard of Mount Wilson, he then showed that these structures could be mapped back onto the Sun.

Wilcox was a graduate of Iowa State College (BS 1948) and the University of California at Berkeley (PhD 1954). He was a physicist with the Lawrence Radiation Laboratory from 1951 to 1961. After spending 1961-62 as a

visiting physicist at the Royal Institute of Technology in Stockholm, he returned to the University of California to work at the Space Sciences Laboratory from 1964 to 1971.

In 1971 he joined the faculty of Stanford University as an adjunct professor, a position he held until his death. There, together with Philip Scherrer, he designed and directed the construction of the Stanford Solar Observatory. Originally designed to permit measurements of the mean magnetic field of the entire Sun, observed as though it were a distant star, the facility has enabled researchers to make extremely accurate observations of the Sun's magnetic field, rotation and oscillations. The observatory also provides daily magnetic maps of the Sun for a systematic study of the evolution of the large-scale structure of magnetic fields. Observations of solar oscillations have played an important part in the work at the observatory. The solar 160.01-minute oscillation, discovered by observers in the USSR, was confirmed at Stanford in 1977, and recently both acoustic-mode and gravity-mode oscillations have been observed there.

Wilcox developed many innovative techniques to extract signals from the variety of noisy data that often plague researchers in solar-terrestrial physics. He had perception in attacking fruitful problems and persistence to devote himself to difficult physical puzzles from which others might shy away. Over the past decade, he and his associates established the connection between the sector boundaries of the interplanetary magnetic field and areas of strong vorticity at the lower boundary of the Earth's stratosphere. The effect, though small and of variable magnitude, has been independently confirmed and may be of great importance in weather and climate models.

Wilcox played an important role in the American Geophysical Union. He served as secretary of the Section on Interplanetary Physics 1970-74, and as associate editor of the *Journal of Geophysical Research* 1973-75.

Among his efforts to promote international cooperation and exchanges, Wilcox arranged extended visits to Stanford by researchers from many countries, including the USSR, China, Japan, England, France, Italy, Denmark and Sweden. The collaborations led to exciting and enlightening cultural exchanges, as well as important scientific results.

Wilcox was known to his scientific associates not only for his research accomplishments and stimulating ideas, but for his gentle manner of giving help. He was a talented clarinet player, and deeply loved chamber mu-

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WILCOX

At home and wherever he traveled, he always made time for musical events. At the request of his family, Stanford University has created the John Marsh Wilcox Fund in his memory, dedicated to the acquisition of library materials in solar-terrestrial physics.

PHILIP H. SCHERRER
Stanford University

Frank G. Dunnington

Frank G. Dunnington, professor emeritus of physics at Rutgers University, died with his wife, Frances, in an automobile accident on 1 July 1983, near his retirement home in Florida. He was 80.

Born in Colorado Springs, Dunnington graduated in electrical engineering at the University of California, Berkeley, in 1929. His PhD in physics in 1932 was also from Berkeley. He devoted the following few years, as post-doctoral fellow at Berkeley and Caltech, to measuring e/m with high precision by a method suggested by Ernest O. Lawrence.

Dunnington joined the physics department at Rutgers in 1937, spent the years 1941-46 on radar research as a staff member of the MIT Radiation Laboratory, and returned to Rutgers after the war as chairman of the physics department. Largely through his efforts, Rutgers established a major research-oriented physics department. Almost overnight, the number of positions in physics was more than doubled, significant funds were made available by the University for research programs in low-temperature physics and magnetic resonance, and one of the first research contracts with the Office of Naval Research was negotiated.

With graduate students, Dunnington continued work on fundamental atomic constants, now including h/e . His interests later turned to radiation

science, and he served, by appointment of the Governor of New Jersey, on a number of advisory panels and commissions for establishing state standards in radiation safety. At the time of his retirement from Rutgers, he was director of the Radiation Sciences Center.

For his 1937 paper on e/m (*Phys. Rev.* 43, 475), Dunnington took extraordinary measures to ensure that he did not know while taking measurements whether they were coming out "high" or "low." The numerical value for e/m depended on a certain angle; a shop technician made random turns of a crank and thereby set the zero for that value before measurements were started. Only after all data had been recorded, the apparatus had been dismantled and the paper written (save for the last sections), was the critical angle measured and numerical value for e/m computed. Dunnington's method might well serve as a model of impeccable objectivity.

RICHARD T. WEIDNER
Rutgers University

F. Russell Petersen

F. Russell Petersen, a physicist at the National Bureau of Standards, died on 7 December 1983 following open heart surgery.

He was born 21 August 1930 in DeSmet, South Dakota, and received his BS degree from South Dakota School of Mines and Technology in 1952. After serving in the US Navy during the Korean War, he attended Berkeley, receiving his doctoral degree in physics in 1961.

Petersen joined the National Bureau of Standards as a research physicist in 1961. He designed, built and tested the first hydrogen maser at NBS. From 1969 to 1972 he worked with stabilized CO₂ lasers and assisted in the measurement of their frequencies. This work

PETERSEN

