came a professor of physics at the Université Pierre et Marie Curie.

Gary K. Starkweather of Apple Computer is the recipient of the David Richardson Medal. He is cited for "contributions to the technology of laser xerography printing and to the realization of practical laser printers." Starkweather's work led to the development of the optical path features required to compensate for nonparallel facets in rotating-polygon scanning equipment.

Starkweather received an MS from the University of Rochester in 1966. He began working for Xerox in Rochester in 1964 and was a senior research fellow at the company's Palo Alto Research Center from 1971 to 1988. He then joined the advanced technology group at Apple.

This year the R. W. Wood Prize, which recognizes a discovery, scientific or technological achievement, or invention in optics, is shared by Thomas F. Deutsch of Massachusetts General Hospital, Daniel J. Ehrlich of MIT Lincoln Laboratory and Richard M. Osgood of Columbia University. The three are cited for "invention of laser photochemical deposition and the application of laser-induced photochemical reactions to materials processing." This work, which has applications in semiconductor device processing, was performed while the three were at Lincoln Laboratory in the late 1970s and early 1980s.

Deutsch earned a PhD in applied physics from Harvard University in 1961. From 1960 to 1974 he worked at Raytheon Company, and from 1974 to 1984 he was at Lincoln Laboratory. In 1984 he became a research physicist in the dermatology department at Massachusetts General Hospital.

Ehrlich received a PhD in optical engineering from the University of Rochester in 1977. He then joined Lincoln Laboratory, where he has served as a group leader in the microelectronics and submicrometer technology groups. He is currently a senior staff member there.

Osgood earned a PhD in physics from MIT in 1973 and was a researcher at Lincoln Laboratory from 1973 to 1981. He then moved to Columbia University, where he is currently a professor of applied physics and Higgins Professor of Electrical Engineering.

At the Conference on Optical Fiber Communication held in February in San Diego, California, the 1991 John Tyndall Award, given jointly by OSA and the IEEE Lasers and Electro-Optic Society for contributions to fiberoptics technology, was presented to David N. Payne of the University of Southampton in England. OSA cited Payne for "outstanding contributions to the design, measurement and fabrication of optical fibers, sensors and fiber devices." Payne's achievements in this area include developing a high-gain erbium-doped fiber amplifier and elucidating second harmonic generation in fibers.

Payne received a PhD in optical communications from the University of Southampton in 1976. He has been a researcher there since 1969 and is currently a deputy director of the university's optoelectronics research center.

In addition to the awards described above, OSA presented the Charles Hard Townes Award to Elias Snitzer of Rutgers University at the May CLEO–LEOS Meeting (see PHYSICS TODAY, April, page 75).

OSTERBROCK AND OTHERS RECOGNIZED BY AAS

At its January meeting in Philadelphia, the American Astronomical Society announced the winners of its 1991 awards.

Donald Osterbrock of Lick Observatory of the University of California, Santa Cruz, received the Henry Norris Russell Lectureship, the society's highest honor, which recognizes lifetime achievement. The award citation called Osterbrock "a leader in the investigation of the properties of gaseous nebulae" and praised his "development of diagnostic tools aimed at understanding the physical conditions in ionized gas." The citation also noted his textbooks, which it described as "the standards in the field." Osterbrock's other research topics have included quasars and active nuclei of galaxies, galactic structure and interstellar matter.

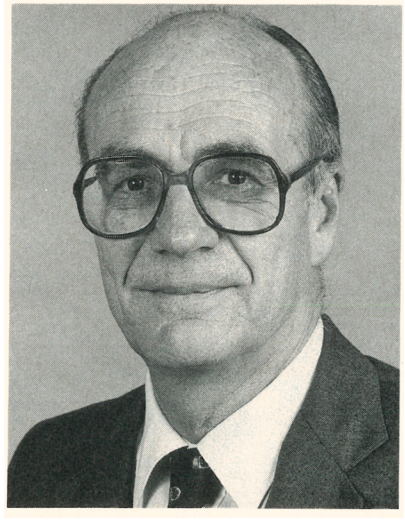
Osterbrock was educated at the University of Chicago, where he received a BS (1948), an MS (1949) and a PhD in astronomy (1952). He served on the faculties of Caltech from 1953 to 1958 and the University of Wisconsin, Madison from 1958 to 1973. He then joined the University of California, Santa Cruz, where he is a professor of astronomy and astrophysics at Lick Observatory.

Wallace L. W. Sargent of Caltech received the 1991 Dannie Heineman Prize for Astrophysics, which is jointly administered by AAS and the American Institute of Physics. Sargent was chosen for his work on Lyman-alpha clouds. The citation credited his research with "opening up a whole new field of astronomy.... He has gained unique information on the gaseous components of galaxies and on the nature of the intergalactic medium."

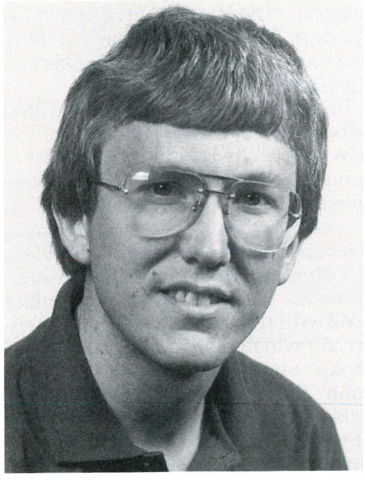
Sargent studied at the University of Manchester in England, earning a BSc (1956), an MSc (1957) and a PhD in astrophysics (1959). In 1966 he joined the faculty of Caltech, where he is currently the Bowen Professor of Astronomy.

The 1991 Newton Lacy Pierce Prize, which honors achievement in observational astronomical research, went to Kenneth Libbrecht of Caltech for his work in helioseismology. He was cited for building and operating an instrument to measure solar oscil-

Donald Osterbrock



Wallace Sargent



Kenneth Libbrecht

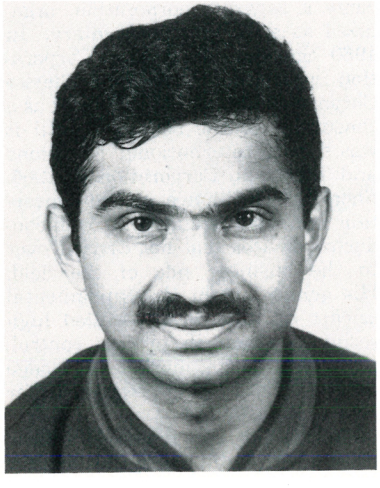
lations, leading to "the best available observations of the frequencies which probe most of the solar interior."

Libbrecht joined Caltech after receiving a BS from Caltech in 1980 and a PhD in physics from Princeton University in 1984. He is an associate professor of astrophysics there.

AAS presented this year's Helen B. Warner Prize to Shrinivas Kulkarni, also of Caltech, for his work on a number of topics, including the interstellar medium and optical and radio interferometry. Kulkarni was cited for his participation in the discovery and statistical analysis of millisecond pulsars in globular clusters, which "will reveal fundamental truths about the dynamics of globular clusters that can be obtained in no other way."

After earning a bachelor's degree from the India Institute of Technology in Delhi, Kulkarni studied at the University of California, Berkeley, where he received a PhD in astronomy in 1984. He then went to Cal-

Shrinivas Kulkarni



tech, where he is currently an associate professor of astronomy.

Last fall the AAS awarded Henri Chretien Research Grants, which are intended to support work at international observatories, to two research teams: Jill Bechtold (Steward Observatory, University of Arizona) and Adam Dobrzycki (Copernicus Astronomical Center, Warsaw); and Richard Green (Kitt Peak National Observatory) and Keliang Huang (Nanjing University).

Bechtold and Dobrzycki were given $12 000 to use machinery developed by Dobrzycki to analyze the large set of data obtained by Bechtold from two new observational studies of the Lyman-alpha "forest." To complete the project, Dobrzycki plans to visit Steward Observatory for a year, and Bechtold will spend several months in Poland.

Green and Huang received $8000 to conduct detailed studies of quasar absorption lines at very high spectral resolutions, which will elucidate physical conditions in the early universe. The grant will help pay for Huang's research at Kitt Peak.

In addition to the awards listed above, AAS's high-energy astrophysics division presented its 1991 Bruno Rossi Prize to John A. Simpson, who is the Arthur H. Compton Professor of Physics emeritus in the Enrico Fermi Institute and department of physics at the University of Chicago. He was cited for "seminal contributions to the understanding of cosmic rays, comets and solar activity, with particular note of his pioneering development of neutron detectors and his experiment on board the Ulysses spacecraft." Simpson earned a PhD in physics from New York University in 1943 and joined the University of Chicago faculty in 1945.

IN BRIEF

Princeton University has appointed three condensed matter theorists. **Ravindra Bhatt,** formerly head of the theoretical physics department at AT&T Bell Laboratories, is now a professor of electrical engineering in Princeton's engineering department and an associate faculty member of the physics department. **F. Duncan M. Haldane,** whose previous position was at the University of California at San Diego, is a professor in Princeton's physics department. And **Raymond Goldstein,** who received his PhD from Cornell University and was a postdoc at the University of Chicago's Fermi Institute, has joined the Princeton physics faculty as an assistant professor. In addition to these condensed-matter-physics appointments, Princeton also has hired **Herman Verlinde,** who specializes in particle theory, as an assistant professor of physics, and **Michael Aizenman,** who works in mathematical physics, as a professor of mathematics and physics. Verlinde received his PhD from the University of Utrecht and worked as a research assistant and then a theoretical fellow at Princeton before receiving his current appointment. Aizenman was most recently a professor at New York University's Courant Institute of Mathematical Sciences.

Joseph F. Thomas, who since 1984 has been chairman of the department of mechanical and materials engineering at Wright State University in Dayton, Ohio, has been named dean of the university's school of graduate studies and associate vice president for research.

Ronald Cohen has joined the staff of the Geophysical Laboratory at the Carnegie Institution of Washington to begin a program in theoretical mineral physics. Cohen was most recently a staff member of the condensed matter and radiation sciences division at the Naval Research Laboratory, also in Washington, DC.

OBITUARIES

William Shockley

William Shockley, Nobel laureate and coinventor of the transistor, died on 12 August 1989 in Palo Alto, California, at the age of 79.

Shockley was born in London to American parents. Reared in California, he received his BS from Caltech in 1932 and his PhD from MIT in 1936. Later that year he joined AT&T Bell Laboratories at their West Street location in New York City. His first work there, in the vacuum tube research department, included studies of electron multipliers and radar. His principal interest, however, was in solid-state phenomena, and the focus of his research soon shifted to the behavior of electrons in crystals. These studies, which included the development of rectification theories, ignited Shockley's fascination with solid-state electronic devices.

Shockley's work at Bell Labs was interrupted during World War II, when he held several US government positions, including director of research for the Navy's Anti-Submarine Warfare Operations Research Group and expert consultant in the Office of the Secretary of War.

In 1945 Shockley returned to Bell Labs. Mervin Kelly, president of the labs, was excited about the prospect of using semiconductors as electronic elements. To explore this possibility, a research group was formed under the supervision of Shockley and Stanley Morgan, a chemist. The group's activities culminated in December 1949 with the invention of the transistor, for which Shockley and two other group members, Walter Brattain and John Bardeen, received the Nobel Prize in Physics in 1956. In 1954 Shockley was named director of transistor physics research at Bell Labs.

The decade following World War II was a particularly productive period for Shockley. Besides providing leadership for the semiconductor group, he also inspired much of the related activity of the Bell Labs chemists, metallurgists and engineers. His book *Electrons and Holes in Semiconductors* (Van Nostrand, New York, 1950) quickly became a classic in the field, and he produced a stream of scientific articles and patent applications. He was a visiting lecturer at Princeton in 1946 and at Caltech in 1954 and 1955. He also continued to serve the government, as scientific adviser for the Joint Research and Development Board from 1947 to 1949 and as deputy director of the Weapons Systems Evaluation Group of the Department of Defense in 1954 and 1955.

In 1955 Shockley left Bell Labs to join Beckman Instruments. A new operation called the Shockley Semiconductor Laboratory was set up in Palo Alto, California, to do research, development and production of transistors and other semiconductor devices. In 1958 the Shockley lab became a separate corporation, organized as a Beckman subsidiary. In 1960 Shockley Transistor Corporation was acquired by the Clevite Corporation; Shockley continued as a consultant to the company until it was sold to International Telephone and Telegraph Corporation in 1965. Shockley's brilliance in the conception and understanding of semiconductor devices had not carried over to the business side of the field. His genius lay in the fundamental science of what is now called high technology, not in process control, packaging design, market knowledge or the many other requisites for commercial success.

In 1965 Shockley renewed his association with Bell Labs in the capacity