Obituaries

Prepared by the Historical Astronomy Division

LAWRENCE HUGH ALLER, 1913–2003

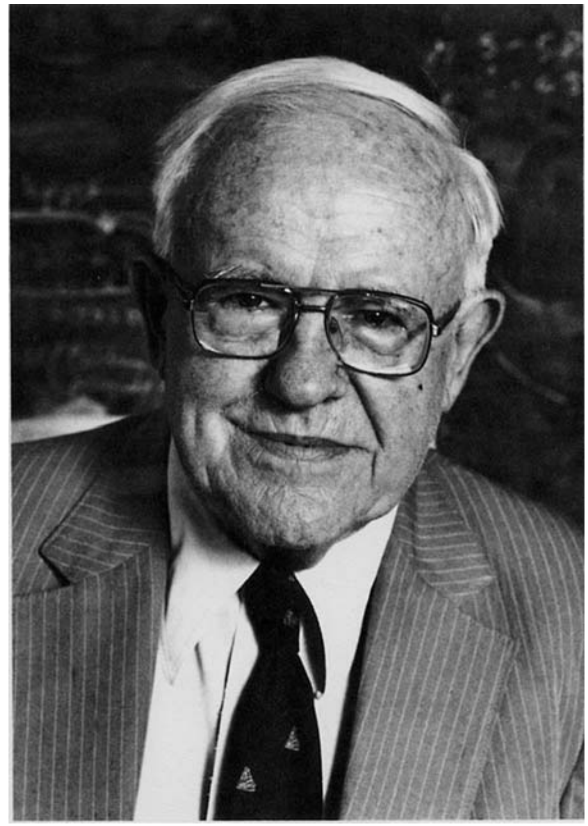
The announcement still lies in my inbox: ''Lawrence Aller died last Sunday.'' On 16 March 2003, one of the world's fine astronomers passed away at the age of 89, leaving behind a legacy that will ripple as long as there are students of the celestial science, one that incorporated observation, theory, education, care, decency, and kindness.

Lawrence was born in the humblest of conditions in Tacoma, Washington, on 24 September 1913. His mother, Lella (Belle) Allen, was a homemaker and his father Leslie Aller, was an occasional printer and gold prospector who thought that the use of the mind was a waste of time. With fierce persistence and dedication, Lawrence pulled off a feat that would probably not be possible now: getting into college without having finished high school, the result of being dragged to work in his father's primitive gold mining camp. His interest, sparked by leaflets from the Astronomical Society of the Pacific and by Russell, Dugan, and Stewart's venerable textbook, led him to a correspondence, and finally a meeting, with Donald Menzel of Harvard, who persuaded the admissions director of the University of California at Berkeley to admit him in 1932.

From there, Lawrence went on to graduate school at Harvard and the Harvard Society of Fellows, where he studied with Menzel and developed his interest in stellar and nebular astronomy. After working in the War effort, he made his professorial debut at Indiana University, where he stayed until 1948 before leaving for the University of Michigan. Residing there for the next 14 years, he established his research reputation and helped develop the Michigan graduate program. In 1962, the opportunity arose to return to California, to UCLA, where he again was instrumental in founding a PhD program. There he stayed, through his retirement in 1984, doing research right up to the end. Eight other schools received him as visiting professor.

Lawrence knew that to make inroads into astronomy, he needed to apply physics to the observations, which he ardently sought. Little pleased him more than gathering photons, except perhaps for making atomic calculations with which he could analyze spectra. His real love was gaseous nebulae, specifically planetary nebulae (which he called his ''hobby''), the graceful shells of gas surrounding dying stars that are making their transitions to becoming white dwarfs. His range of simultaneous research projects was staggering. Having been an undergraduate student at Michigan in the late 1950s, I followed him to UCLA to work on my doctorate. When I arrived, I found him engaged in stellar spectroscopy, solar research, nebular theory, nebular observations (he tossed a box of plates at me and said in effect, ''here is your thesis''), and of all things Mie scattering theory to explain the zodiacal light!

A list of his discoveries and influences is impressive. A sample: Lawrence played a major role in Menzel's group, which produced the famed ''Physical Processes in Gaseous Nebulae,'' an 18-part series that ran in the *Astrophysical Journal* from 1937 to 1945 and that explained nebular spectra. He was among the first to promulgate what in the 1940s was utter heresy, that the chemical compositions of stars could differ from one another. He was the first to observe gradients in spiral galaxies, which ultimately turned out to be the result of abundance variations. David Bohm and Lawrence established the existence of Maxwellian velocity distributions in nebular plasmas. Leo Goldberg, Edith Müller, and he were instrumental in establishing the chemical composition of the Sun. His observations of planetaries were legion. Never content with current observational and analytical capabilities, he sought out the latest equipment, from image tubes through CCDs to the best computers, ever looking ahead. His work was honored in 1992, when he received the American Astronomical Society's Russell Prize.



Lawrence Henry Aller
Photo courtesy of UCLA

Perhaps Lawrence's greatest legacy involved his teaching and writing. At Michigan, he taught a two-semester course in advanced general astronomy that covered nearly everything, in addition to a remarkable four-semester sequence in astrophysics (general, stellar atmospheres, nebular astrophysics, and stellar interiors). These were backed up by an extraordinary set of books. In 1943, Goldberg and he turned out the seminal *Atoms, Stars, and Nebulae*. (A solo third edition was published in 1991.) Then in 1953 arrived *The Atmospheres* *of the Sun and Stars* (revised a decade later), a tour de force on the physics of stellar plasmas and radiative transfer that became the bible of a generation of astronomers. *Nuclear Transformations, Stellar Interiors, and Nebulae* appeared a year later, and *Gaseous Nebulae* two years after that (rewritten in 1984 as *Physics of Thermal Gaseous Nebulae*). Not having a computer available in the early years, he used his students, creating mammoth *Aller Problems* that solved the equations for results that went into the books. Never formally published were two massive tomes of advanced general astronomy. To those of us lucky enough to have them, they serve as references to this day. His students, both undergraduate and graduate, are everywhere, their own students in turn carrying on Lawrence's ideas and work.

In 1941, Lawrence married Rosalind Duncan Hall (who survives), and together they raised three children: Hugh, Gwen, and Raymond. Not only did one son become an astronomer, but so has one granddaughter (a dynasty established). Lawrence was absorbed by news and politics. He hated injustice of any kind, and let you know about it. He could entertain for hours with stories of his youth and of other astronomers, never realizing that he would also be the source of affectionate stories that would be told and retold by his own students. Of beautiful heart, he was a good father, both to his own children and to those he adopted as his students, none of whom, having been taught by him, will ever forget.

Incredibly prolific, his vita lists over 500 publications, his first (in 1935) involving observations of the spectrum of Nova Herculis 1934, his last (in 2003!) the abundances of Hu1-2, fittingly one of his beloved planetary nebulae, one with a wonderfully deviant chemical composition.

James B. Kaler
Department of Astronomy University of Illinois

HORACE WELCOME BABCOCK, 1912–2003

Horace Welcome Babcock
Photograph courtesy of Carnegie Observatories, Carnegie Institution of Washington

Horace Welcome Babcock died in Santa Barbara, California on 29 August 2003, fifteen days short of his ninety-first birthday. An acclaimed authority on solar and stellar magnetism and the originator of ingenious advances in astronomical instrumentation in his earlier career, he served as Director of Mount Wilson and Palomar (later Hale) Observatories from 1964 until his retirement in 1978. The founding of the Carnegie Institution of Washington's Las Campanas Observatory in Chile was the culmination of his directorship.

Horace was born in Pasadena California on 13 September 1912, the only child of Harold Delos Babcock and Mary G. Henderson. His father, an electrical engineer and physicist by training, had been hired by George Ellery Hale to work at the recently founded Mount Wilson Solar Observatory beginning in 1909. Thus Horace spent much of his boyhood on Mount Wilson in the company of astronomers. Horace developed an early interest in astronomy, worked as a volunteer solar observer at Mount Wilson and published his first paper in 1932, with his father. He was fascinated by fine mechanisms and by optical and electrical instruments. After graduating from Caltech with a degree in structural engineering in 1934, he earned his PhD in astronomy at Lick Observatory in 1938. His dissertation provided the first measurement of the rotational velocity curve and a derivation of the mass-to-luminosity ratio for M31; this work is still cited in reviews of the study of ''dark matter.''

Horace served as a research assistant at Lick Observatory (1938 39) and an Instructor at the University of Chicago's McDonald and Yerkes Observatories (1939–41) under Otto Struve. He undertook radar-related wartime electronics work at the MIT Radiation Laboratory (1941–42) and then worked on aircraft rocket launchers as part of the Caltech Rocket Project (1942 45). This project brought him into contact with Ira S. Bowen, head of the project's Photographic Division. Impressed with his knowledge of electronics, Bowen invited Horace to join the scientific staff of the Mount Wilson and Palomar Observatories starting on 1 January 1946, the day Bowen took up his duties as Director. The appointment required Horace to spend about half his time developing instrumentation Bowen deemed necessary for the Observatory, leaving him otherwise free to pursue independent research in astronomy.

Horace headed the Mount Wilson grating ruling laboratory (earlier headed by his father) from 1948 until 1963. Under Horace's supervision, the ruling engines were further perfected and equipped with interferometric control to produce the largest and most efficient diffraction gratings ever made up to that time. The Carnegie Institution supported this activity and supplied ''Babcock Gratings'' free of charge to some two-dozen observatories and laboratories around the world, in addition to those installed at the Mount Wilson and Palomar Observatories. Horace invented and built automatic guiders for astronomical telescopes and the first electronic exposure meter for astronomical spectroscopy. Well ahead of his time, he proposed and explored experimentally the possibility of using adaptive optics to overcome the blurring effects of turbulence in the Earth's atmosphere. Any historical account of the status of adaptive optics today must begin with a reference to Horace Babcock's 1953 paper.

In his first independent research venture as a new staff member beginning in 1946, Horace devised and successfully applied a method for detecting, for the first time, magnetic fields in stars other than the Sun. Thus began an extensive study of magnetic stars that attracted many followers and brought worldwide recognition to its author. In 1952 he devised the first photoelectric solar magnetograph, which allowed the first detection of the Sun's weak general magnetic field. His subsequent researches in collaboration with Harold Babcock demonstrated that the Sun's general dipolar field reverses polarity in successive sunspot cycles. Until about 1957 this work had been done at the Hale Solar Laboratory on Holladay Road in Pasadena. Improved models of the magnetograph developed by Robert F. Howard, in collaboration with Horace, went into operation in the 150-foot solar tower telescope at Mount Wilson in 1959 and later, and similar instruments are now employed at many other solar observatories. In 1961 Horace proposed an explanation of the Sun's 22-year magnetic cycle that contained many of the features still embodied in contemporary theoretical models of the phenomenon. The advance in our understanding of solar and stellar magnetism brought forth by Horace Babcock is a worthy sequel to the pioneering efforts initiated by George E. Hale early in the twentieth century.

Faced with the growing obsolescence of the Carnegie Institution of Washington's facilities at Mount Wilson along with the competition from Caltech's 200-inch telescope, the Carnegie Trustees in 1963 adopted the idea of founding a major observatory in the Southern Hemisphere as its master plan for modernizing the astronomical facilities of the Institution. Upon becoming Director of the Mount Wilson and Palomar Observatories in 1964, Horace Babcock embraced the job of carrying out this plan, although it meant giving up his own science.

Beginning in 1963, and with his usual ingenuity, Horace developed apparatus for measuring astronomical ''seeing.'' In collaboration with John Irwin and others, he carried out site surveys in Chile, Australia and New Zealand with the aim of selecting the best available location for the anticipated array of large telescopes. Some five years of exploration led, in 1968, to the selection and purchase of a 276 square-kilometer tract on Cerro Las Campanas in north central Chile as the site for the new observatory. Babcock and Irwin had first climbed to its summit, on foot, in October 1966.

The team Horace assembled to build the observatory and its infrastructure proved equal to the high standards he set, and they got the job done. The Swope 1-meter telescope was placed into operation at Las Campanas in 1971. The Irénée du Pont 2.5-meter Telescope was completed and dedicated in 1976. The Las Campanas Observatory is the current site of two 6.5 meter optical telescopes constructed there in a collaboration between the Carnegie Institution of Washington, the University of Arizona, Harvard University, the University of Michigan and the Massachusetts Institute of Technology; they were placed into operation in 2000 and 2002. That Las Campanas offers unsurpassed astronomical seeing, and its infrastructure provides ample capacity for even larger telescopes of the future, stands as a testimony to Horace Babcock's vision and stubborn tenacity in acquiring and developing the best possible site for the Carnegie Southern Observatory.

For several years, Horace owned a 26-foot sailboat, which he kept at Redondo Beach. It was his private domain and escape. On many occasions, he invited younger colleagues to sail with him. The boat was equipped with an automatic pilot of Horace's design. It electronically controlled the vessel's heading by sensing the Earth's magnetic field direction relative to the intended course and drove a servomotor to adjust the tiller accordingly. The device was not unlike the automatic guider Horace had built for the 200-inch telescope.

Horace was elected to the National Academy of Sciences in 1954. He was awarded the National Academy's Henry Draper Medal in 1957; the Catherine Wolfe Bruce Gold Medal of the Astronomical Society of the Pacific in 1969; the Royal Astronomical Society's Eddington Medal in 1958 and its Gold Medal in 1970; and the George Ellery Hale Prize of the Solar Physics Division of the AAS in 1992.

Horace leaves a daughter Ann L. Babcock and son Bruce H. Babcock by a first marriage, a son Kenneth L. Babcock by a second marriage (to Elizabeth M. Jackson, who survives him), and a granddaughter. Both marriages ended in divorce.

Those who worked with Horace and knew him well were familiar with his uncommonly reserved nature, and indeed also with his display of hot temper on rare occasions. One familiar with the distinguished scientific accomplishments of his earlier career could recognize in Horace an abiding modesty about them. At a personal level he was gracious and generous. In conversation and at meetings, he considered his words with meticulous care before enunciating them. He could be noticeably ill at ease in public speaking, particularly if an occasion called for extemporaneous remarks. His published writings stand as masterpieces of lucid exposition. In his later years, he was a popular speaker at gatherings of students and amateur astronomers, to whom he offered entertaining and remarkably informative personal stories about his scientific endeavors and early life experiences at Mount Wilson Observatory.

Arthur H. Vaughan
Jet Propulsion Laboratory, California Institute of Technology
(Retired) Mount Wilson Institute, Hale Solar Laboratory

FRANKLYN M. BRANLEY, 1915–2002

Franklyn Mansfield Branley was born in New Rochelle, New York, 5 June 1915, and died of natural causes in Brunswick, Maine, on 5 May 2002, just one month before his 87th birthday. He will be remembered by the hundreds of grateful students he so skillfully introduced to astronomy.

Franklyn Branleys parents were Ella Lockwood and Percival Branley. Mr. Branley was a veteran of the Spanish American war and an insurance salesman for Metropolitan Life. Frank's mother died during a flu epidemic when he was

Franklyn M. Branley
Photo courtesy of Ms. Mary Jane Day

only a few years old. At that time, his sister was taken in by the Lockwood family and he and his two brothers were sent to live with a farm family near Newburgh, New York. His father visited them there on the weekends. Because he contracted polio at a young age, he did not participate in sports except for swimming. He was an avid stamp collector.

After graduating from the New Paltz Normal School (now SUNY), he married his college sweetheart, Margaret Lemon, who became a grade school teacher for a while. After he retired, he and Peg moved from New Jersey to Sag Harbor, New York. When they were both in their eighties, they moved to Thornton Oaks, a retirement community in Brunswick, Maine.

His life had been devoted to education, chiefly writing books that make science accessible to, and fun for, children at the grade school level. There are about 200 of his books in print, or available in school libraries or on the shelves of now grown youngsters who have saved them for their children. His last, published posthumously in fall 2002, ''Mission to Mars,'' has a forward by Neil Armstrong. Frank and his publishers have been able to engage top-flight illustrators with the imagination to envision his concepts. Each one is only about 30 pages, with few words on a page. Thus, each book lights a candle against the cursed darkness.

Branley joined the staff of the American Museum-Hayden Planetarium in September 1956, to run the Planetarium's education program. He came from the New Jersey State Teachers College where he was teaching teachers how to teach science, and had been a guest lecturer at the Hayden for several months. Frank continued his own education while working at the Planetarium, gaining a Masters degree from New York University, and his Ed. D. from Columbia Teachers College. I joined the Hayden staff two weeks after Frank. Many of our friends and professional colleagues are aware of the confusion caused by the coincidence of our arrival and the similarity of our names. Frank did not appreciate it when the payroll department took my deductions from his check. About five years ago, a librarian I met in our travels wanted to know if I still wrote books. Evidently, the confusion persists.

On Friday, 4 October 1957, the Russian satellite, Sputnik, was sent into orbit, surprising the world, and embarrassing our science establishment in the midst of the International Geophysical Year. CBS producers Vern Diamond and Don Hewitt were at the Planetarium on Saturday to plan a Sunday nationwide broadcast concerning this event. Branley and I were the only staff members available for the hour-long show. Richard C. Hottlet was at the Planetarium, and Douglas Edwards was in the CBS studio. It went well. In 1959, Chairman Joseph Miles Chamberlain, then Education Officer of the AAS, Frank Edmondson, AAS Treasurer, and Frank Branley met at the nearby Alden Hotel for lunch. When they had finished, the Society's Visiting Professor program was born. Branley, assisted by his secretary Barbara Harrison, administered the program for several years. The first four in the stable were Harlow Shapley, Seth Nicholson, Frank Edmondson, and Gibson Reaves. This highly successful program is now named for Harlow Shapley.

In 1968, he took the reins of the Hayden as Chairman until he retired in 1972. During that time, we went to taped public shows, but shows for schools continued to be live. The use of tapes for the shows allowed much tighter control over their scientific content, and for more uniformity in their presentation. Gone, however, were ''the live lecturers and their live mistakes,'' as someone complained. This was also the period when we changed from a Zeiss Model 4 star projector to a Zeiss Model 6. This entailed a major renovation of the Sky Theater. Branley also transformed the room with the ceiling model of the Copernican solar system into another theater using eleven screens with 22 slide projectors. This involved a very complex control system taking several months to perfect.

During his whole tenure at the Hayden, Branley organized many workshops for the teachers of the Metropolitan New York area. These were very well conceived and received. Not only did the teachers get useful instruction from professional astronomers, they were also entertained with a behind-the-scenes look at the Planetarium, and could see how the shows were put on. Many brought their classes to see the shows, a welcome occurrence, because all our income came solely from the box office.

Perhaps Frank Branley's greatest direct impact on astronomy, and even the Society, was a program sponsored by the National Science Foundation for 13 years. It was a two-week summer adventure for top-level high school students with a strong interest in science, especially astronomy. They arrived from all over the country, but we never knew quite where they were staying. Every morning, there were at least two concentrated lectures by top astronomers and other specialists. In the afternoon, astronomy graduate students, also from around the country, gave a continuing course in astronomy. The students were either reinforced in their interest in astronomy, or they found out it was not for them. Either outcome was good, as it came early in their lives. The program must have been well respected, for the NSF seldom financed anything like this for more than about three years.

At his death, he was survived by his wife, Margaret, a sister Marion Gray, daughter Mary Jane Day, four grandchildren, and four great-grandchildren. Another daughter, Sandra Kay Bridges, died in 1985.

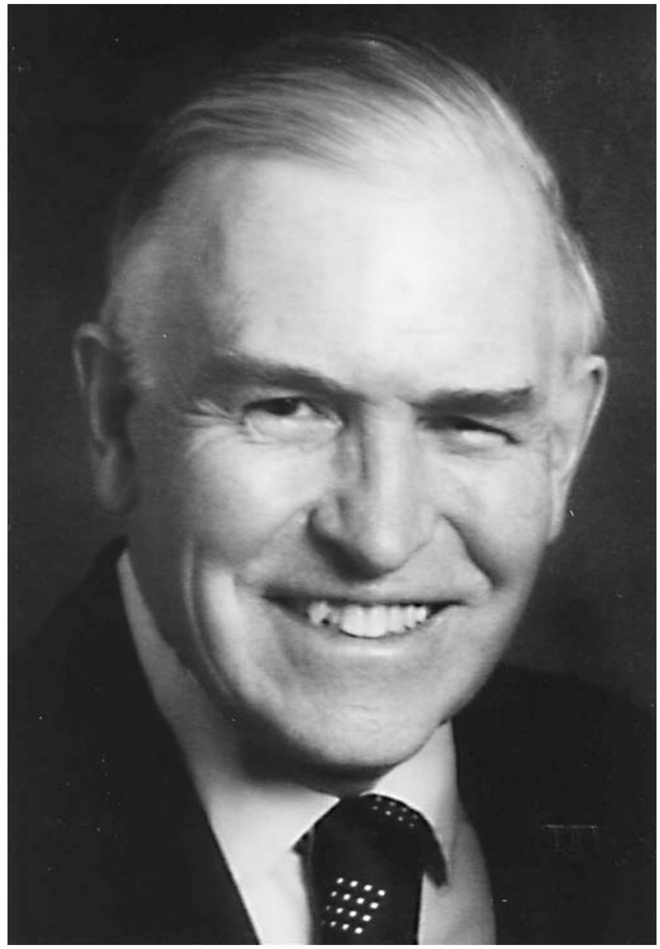
Kenneth L. Franklin
Astronomer Emeritus and Former Chairman American Museum-Hayden Planetarium

WILLIAM F. M. BUSCOMBE, 1918–2003

William Buscombe, an emeritus professor at Northwestern University, died from a massive stroke on 13 March 2003. He was a stellar spectroscopist and was working on the 16th edition of his catalog, entitled ‘‘MK Spectral Classifications’’ at the time of his death.

Bill was born on 12 February 1918 in Hamilton, Canada to Ethel Minett Buscombe and William Henry Buscombe. His mother was a business woman prior to marriage and his father was an executive secretary to a fire insurance company. His interest in astronomy was stimulated by a mathematics teacher in grade school and this interest carried over to his undergraduate years at the University of Toronto where he worked as a research assistant measuring stellar spectra at the David Dunlop Observatory. He earned a BA degree in Mathematics and Physics in 1940. Upon graduation he entered the graduate program in meteorology under the Department of Transport of the Government of Canada and worked as a meteorologist for the Canadian government until 1945. His studies and service eventually led to a MA degree in Meteorology from the University of Toronto in 1948. From the period 1945 to 1948, Bill was an instructor in the Department of Mathematics at the University of Saskatchewan. During the summer of 1947 Bill resumed his research in astronomy working with Andew McKellar in a study of the intensities of molecular bands in R-type stars at the Dominion Astrophysical Observatory. Subsequently, Bill entered into the graduate program in the Department of Astronomy at Princeton University where he worked with Martin Schwarzschild and Lyman Spitzer, Jr. In 1950, he was awarded a PhD in Astronomy for his thesis entitled, ‘‘Spectrophotometry of Early A-Type Stars.’’

Bill joined the staff at the Mt. Wilson and Palomar Observatories as a Fellow of the Carnegie Institution of Washington from 1950–1952. During this period he spent a significant amount of time observing at Mount Wilson studying the variations of atomic absorption lines in the spectra of long period variable stars with Paul Merrill. In 1952 Bill took an astronomer staff position at the Commonwealth Observatory (later called the Mount Stromlo Observatory). When it became part of the Australian National University in



William F. M. Buscombe
Photo courtesy of Ronald Taam

Canberra, Australia, he became a professor of astronomy. Until 1968, Bill observed the stars in the southern hemisphere measuring their radial velocities and classifying them spectroscopically. His research spanned over several directions including studies of the atmospheres of cool giant stars, the Magellanic clouds, novae, and galactic structure. His work led him to become one of the first astronomers to undertake spectral classifications of stars in the southern hemisphere.

Bill briefly returned to the US as a visiting professor in astronomy at the University of Pennsylvania from 1964–1965 and permanently relocated to the US in 1968. Bill was persuaded to leave Australia to join the faculty at Northwestern University as Professor of Astronomy by J. Allen Hynek, the then chair of the department. At that time, the Lindheimer Observatory had been constructed on the Evanston campus and the installation of a new Coudé spectrograph for the 1-meter reflector was planned. However, due to budgetary constraints the Coudé project (estimated at the time to be on the order of 1 million dollars) had to be scrapped and a more modest Cassegrain spectrograph was installed instead. Having lost an opportunity to carry on his favorite research field of high dispersion spectroscopy, Bill settled down to concentrate on teaching the art of astronomical spectroscopy and supervising several PhD students in their research. During the subsequent years he continued and expanded his earlier efforts with Pamela Kennedy in Australia of compiling a photometric and spectroscopic database forming the early basis for his spectral catalogs. He was appointed emeritus professor in the Department of Physics and Astronomy upon his retirement in 1988.

Bill very much loved to teach and to talk to young people about astronomy. His enthusiasm was infectious, and he was a welcome visitor in primary school classes on Chicago's North Shore. His interests in the young students led him to be involved as a faculty associate in the residential colleges of the University. Bill's interest in teaching extended beyond the Northwestern boundaries as he also lectured at other colleges and universities under the auspices of the Harlow Shapley Visiting Lectureship program of the American Astronomical Society and to gatherings of amateur astronomers. He was a member of the American Astronomical Society, Royal Astronomical Society, International Astronomical Union and Sigma Xi. Professionally, Bill was very meticulous in his approach and execution. His desire for perfection was reflected in his teaching as well. Some students felt that he was too demanding, but he had no sympathy for anyone who did not strive to go past mediocrity. He read extensively and made it a point to attend and participate in seminars and colloquia even late in his life. Since he made a very conscious effort to keep up with the latest developments in astronomy, he was very well versed in astronomical literature going back to many years.

He is survived by his wife, Royal, along with three sons (Peter, Martin, and Timothy), four daughters (Dawn, Eve, Lucy, and Katherine), 11 grandchildren, and a great grand child. His family remembers his smile, his wit, his integrity, his knowledge and his helpfulness.

Bill was a man of conviction and an active member of the Society of Friends (Quakers). He was firmly against violence and wars and was quite outspoken, expressing his opinions in public, forcefully and very directly. In private, he was more reserved and showed a good sense of humor. Bill was generous with his time for the cause of ''Reading for the Blind,'' regularly spending an afternoon at a taping session to record books on astronomy. He enjoyed listening to classical music. Bill was a loyal and generous friend.

Ronald E. Taam
John D. R. Bahng
Dearborn Observatory, Northwestern University

ERNEST HURST CHERRINGTON, JR. 1909–1996

Ernest Hurst Cherrington, Jr.
Photograph courtesy of the Shane Archives of the Lick Observatory

Ernest H. Cherrington, Jr., a long-time member of the AAS, died in San Jose, California on 13 July 1996, following a long illness. He had a short but active career as a research astronomer at Perkins Observatory at Ohio Wesleyan University in Delaware, Ohio before World War II, in which he served as an officer in the Army Air Force. After the war ended he turned to full-time teaching and administration at the University of Akron, and then at Hood College in Frederick, Maryland.

Ernest was born on 10 September 1909 in Westerville, Ohio, where his father, Ernest H. Cherrington, Sr., was a leader in the temperance movement and publisher of *American Issue*, a Prohibitionist magazine. Ernest Jr.'s mother, Betty Clifford (née Denny) Cherrington, was a homemaker. He was an outstanding student in high school and at Ohio Wesleyan University, which he entered in 1927. The little university's Perkins Observatory with its 69-inch reflector, briefly the second largest telescope in the United States, had just been built and gone into operation. After graduating with a BA magna cum laude in astronomy in 1931, Ernest stayed on one more year and earned his MS with a thesis on the motion of material in the tail of Comet Morehouse, supervised by Nicholas T. Bobrovnikoff.

In 1932 Ernest entered the University of California at Berkeley as a graduate student, with a one-year teaching assistantship in the Astronomical Department. This was followed by a two-year Lick Observatory Fellowship. In June 1933 he married Ann McAfee Naylor, who had been a classmate at Delaware High School and Ohio Wesleyan. Ernest did his PhD thesis on spectrophotometry of the Mg I b lines in the solar spectrum, using a high-resolution grating spectrograph on the Berkeley campus, designed by C. Donald Shane, his adviser. In this thesis, Ernest tested and improved the then current theory of strong absorption lines in stellar atmospheres. He also spent several short periods at Lick Observatory on Mount Hamilton, working in stellar spectroscopy with Joseph H. Moore.

After earning his PhD in 1935, Ernest taught mathematics and astronomy for one year at Syracuse University, and then in 1936 returned to Ohio Wesleyan as an assistant astronomer and instructor in physics and astronomy. In 1940 he was promoted to assistant professor. He did good spectroscopic research on Be stars, especially a long study of the variations in the spectrum of γ Cas, an unusually active star of this class which he followed as it threw off several shells. It was a program well suited to the telescope, spectrograph, and site available to him. Ernest attended several meetings of the AAS, reported on his research in oral papers, and published them. However after America entered World War II he went into the Army Air Force in 1942, serving as a Captain in the Air Force Training Command. He had an important job directing ground training of officers, cadets, and enlisted men at various fields in California and New Mexico.

After the war, although he could have returned to Perkins Observatory, he realized that the future was not hopeful for astronomical research there, and decided to switch to academic administration. He was at Centenary College, Louisiana for two years, 1946–48, and then went to the University of Akron as professor of astronomy and dean of the College of Liberal Arts from 1948 to 1960, then of its Graduate Division from 1960 to 1967. He loved teaching astronomy and continued to do so while holding these deanships. Ernest was a good writer, and he published several articles on astronomy and science in the *New York Times Sunday Magazine* and other mass-circulation magazines in those years.

Ernest retired at Akron in 1967 but moved to Hood College in Frederick, Maryland, as professor of astronomy, a full-time teaching position with no administrative duties. Soon after arriving there he published *Exploring the Moon with Binoculars*, a very popular book in the early days of the NASA program of lunar photography from unmanned space vehicles. All the ground-based photographs in his book came from Lick Observatory, most of them taken by Moore and Fred Chappell, with whom he had worked. About 1979 he retired from Hood College and he and his wife moved to San Jose, near the home of their surviving son, Robert N. Cherrington. Ernest was always a good family man, devoted to his wife and children. I met Ernest at his home in San Jose and interviewed him several times in preparation for the Lick centennial in 1988; he had warm memories of Lick and the Berkeley Astronomical Department. In 1984 he had updated his book to *Exploring the Moon through Binoculars and Small Telescopes*, with additional photographs from lunar orbiting vehicles and one taken by Neil Armstrong of Buzz Aldrin on the moon's surface. Ernest's wife Ann died in 1988 and he followed her eight years later.

There are about one hundred letters to, from, or about Ernest, written in the years 1931 to 1948, in the Mary Lea Shane Archives of the Lick Observatory, McHenry Library, University of California. These letters, his published papers and book, and Perkins Observatory annual reports, together with information provided by Robert N. Cherrington and my own notes and memories of conversations with Ernest and Ann formed the basis of this obituary article.

Donald E. Osterbrock
Lick Observatory, University of California, Santa Cruz

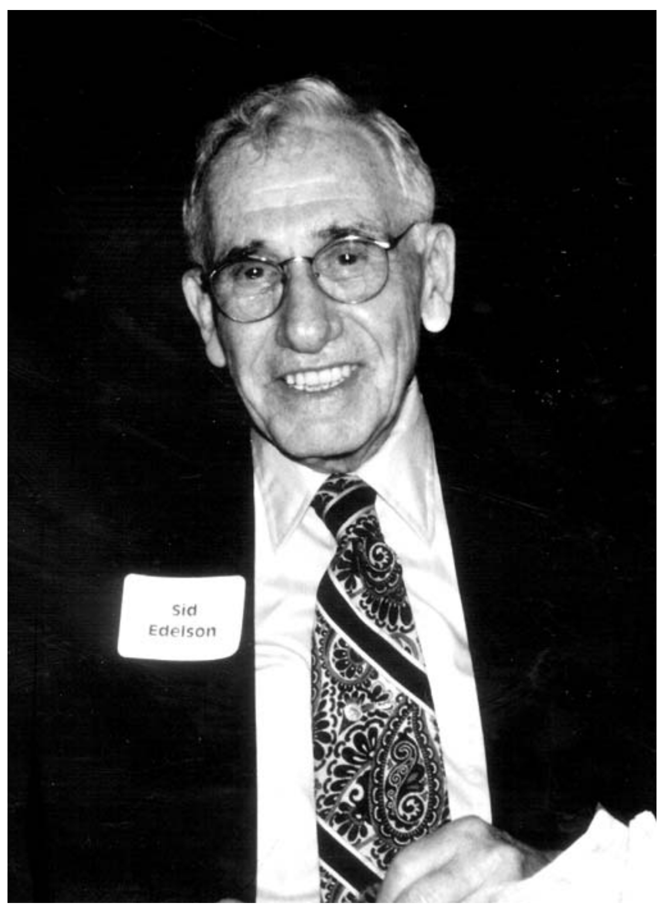
SIDNEY EDELSON, 1916–2002

On 24 March 2002, the solar physicist Sidney Edelson died in Santa Barbara, California. Sidney was born in Brooklyn, NY on 24 August 1916 to Benjamin and Sarah Edelson. His father worked in the garment industry. He obtained his BA from Brooklyn College (1938) and a MA from New York University (1949). He entered Georgetown University in 1950 and received both a MA (1953) and PhD (1961). His PhD thesis was entitled ''A Study of Long and Short Term Variations in Solar Radiation at Radio and Optical Wavelengths.''

When the U.S. entered World War II, Sidney enlisted as an apprentice seaman and retired as a Lt. Commander. He was active in both the European and Pacific theaters. He was captain of a minesweeper in the northern Atlantic and commanded a LST vehicle landing troops at Normandy on Omaha beach. Later on, he was part of the amphibious forces that landed the 5th Marine Division at Okinawa. After the war, he commanded the USS Typhon repatriating Japanese POWs from China to Sasebo, Japan. For this, he was given a certificate of appreciation by Chiang Kaishek.

After the war efforts, he served in 1946–47 as a port captain for the China Waterways Transport in Shanghai. It was at this time that he met and married Erny Margaret Anderson, a surgical nurse. They were unable to have children because of a bayonet wound suffered by Erny during a 1937 Japanese attack upon the Catholic Mission hospital where she was working.

The majority of his research work was in the area of solar physics; he noted the time relationships between centimeter wavelength bursts and Hα solar flares (1959), studied the



Sidney Edelson
Photo courtesy of Edith Caballero

short term variations in the solar radiation at radio and optical wavelengths (1961), observed the solar flux variations at mm and cm radio wavelengths (1973), and pointed out the close association of the emission features at 9 and 3.3 mm with the solar magnetic field structure (1973).

Sidney's professional career included research work on solar physics at a number of institutions including the U.S. Naval Observatory (1948–56), the U.S. Naval Research Laboratory (1956–1964), NASA Ames Research Center (1964–1972) and the University of Graz Austria (1972–1974). During the period 1975–1985, he acted as a consultant for solar energy initiatives and in 1978–1981, he served as a volunteer science advisor for Congressman Robert Lagomarsino in Santa Barbara, California. Upon the death of his wife Erny in 1992, he endowed two Erny Margaret Edelson memorial scholarships at Santa Barbara City College, one in nursing and one in radiography. In honor of Carl Sagan, he endowed a third scholarship in planetary sciences. Also in honor of his wife, he donated ancient works of Chinese art to the Santa Barbara Museum of Art.

One of the activities for which he was most proud was his support, at Ames, of the Apollo 11 lunar landing mission, an activity for which he received an Apollo Achievement Award. He had both a distinguished military career and a successful scientific career. Sidney's siblings are his brothers Leon and Jack Edelson and his sisters, Edith Caballero, Dr. Terry Smolar, and Sophia Forman (now deceased).

Donald K. Yeomans
Jet Propulsion Laboratory/Caltech

Robert Fleischer
Photo courtesy of Marie Fleischer

ROBERT FLEISCHER, 1918–2001

Robert Fleischer was born 20 August 1918 to Leon and Rose Fleischer in Flushing, NY. He was educated at Harvard, receiving his BS in 1940, MA in 1947, and PhD in 1949. He specialized in geophysics and solar-terrestrial relations. Fleischer joined the faculty at Rensselaer Polytechnic Institute advancing from Assistant to Full professor in 1958. As Director of the RPI Observatory, Fleischer attempted to bring modern astronomy to the institutions in the Albany area by procuring the funds to build a radio telescope. He left for the National Science Foundation (NSF) before the observatory was completed. It is a testament to his character that without his enormous energy, organizational, and fundraising abilities, the radio telescope project languished after he left.

Fleischer joined the NSF in 1962 as the Program Director for Solar-Terrestrial Research. He was the government-wide Coordinator for the International Quiet Sun Years, and coordinated the 1966 South American Eclipse expeditions. Thereafter, he was appointed Deputy Head of the Office of International Science Activities.

Fleischer is most notably remembered as the head of the Astronomy Section at the National Science Foundation. He brought astronomy into its own at NSF and involved the community in a major way through use of advisory committees. He was dedicated to helping the astronomical community understand the funding system, the political environment, and the various factors in how money is allocated. Fleischer truly believed in the concept that scientists should be making the important decisions about their field. He was instrumental in injecting science into the oversight of the National Observatories.

Relations with the community say a lot about the man, the complexities of his character, and the forces that drove him. Fleischer was passionate in his beliefs and in his devotion to doing the best for astronomy. His strong approach and belief in himself served him well in many ways, but caused him grief from time to time.

Fleischer wrestled with the issue of how to assemble a committee of busy people who had not thought about the problems at hand, provide them with enough background to enable them to comment effectively, and structure any discussion so as to provide effective advice to the agency. Yet, he had a strong sense that NSF, having the broad overview of the situation and a better understanding of the politics of funding, was in a better position to make major decisions than any group of scientists that might be assembled. This ultimately led to confrontation with the astronomical community.

Fleischer was also of the opinion that perhaps the most important advice a committee can give comes, not from the official pronouncements but, from the informal communication which happens when any group of people get together—the one-on-one discussions over coffee, the brief comments heard around the table, and even the general sense of body language. He stressed this to the staff before each meeting. Ironically, his zeal to run an effective meeting made him less receptive to the informal, and even some of the formal, communications from the Committee.

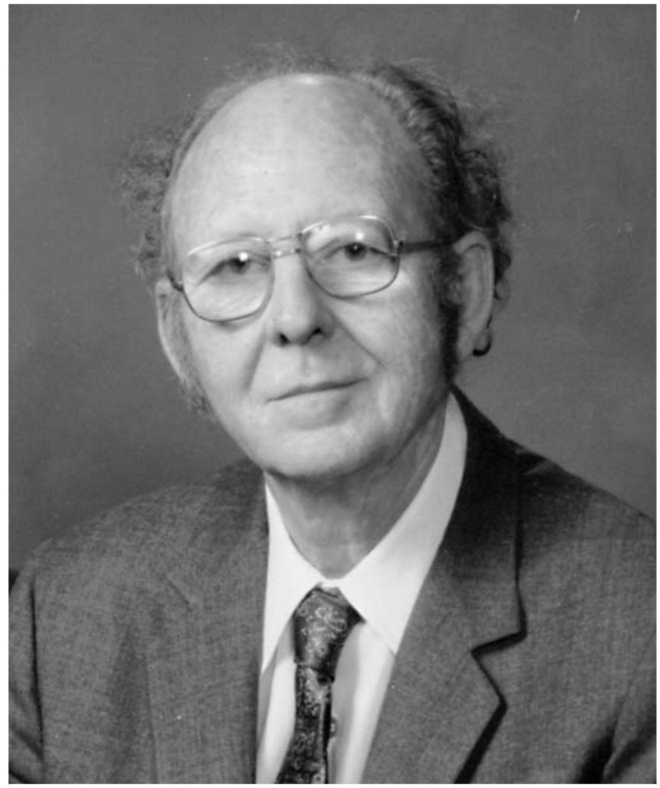
Preparation for meetings of the NSF Astronomy Advisory Committee was intense. The agenda was structured so as to present a maximum amount of information to the Committee. Once the agenda was set, the meetings followed them strictly. As chairman of the Advisory Committee, Fleischer ran the meeting with an iron hand, sometimes cutting off discussion that the Committee might have felt valuable, adding to the sense of the Committee's frustration. As a consequence, the meetings actually had a negative effect on the community. Although Fleischer was a strong believer in helping and encouraging his staff, and arranged for the entire staff of the Astronomy Section to attend both internal and off-site management training courses, his tendency toward an autocratic personal style was unsettling. Pressures from the community and within NSF eventually led to his being transferred from the Astronomy Section in 1975.

Shortly thereafter, Fleischer retired from the government and established his own firm, The Greylock Center, an educational management consulting group that specialized in helping educational institutions in understanding how to deal with the federal government. In this, he was eminently successful. His knowledge of procedures, the timing of the federal budget cycle, and the various factors that are important in making funding decisions were a major asset in his work. And, he thrived on educating newcomers about dealing with the federal bureaucracy. He eventually closed his consulting business in 1984 and retired to a farm in Keedysville, Maryland, where he raised Angus cattle with his third wife, Marie.

Fleischer passed away 14 September 2001 in Raleigh, NC, where he was doing his best to cope with Alzheimer's disease.

Peter B. Boyce
Mary E. Saffell

PRESTON F. GOTT, 1919–2002



Preston F. Gott
Photo courtesy of Orene Peddicard-Gott

Preston F. Gott, Professor Emeritus of Physics and former Director of the Observatories at Texas Tech University, died 13 January 2002 after a bout with cancer. Mr. Gott was born 21 November 1919 in Waxahachie (Ellis County), Texas. He received his Bachelor of Science and Master of Arts degrees from the University of Texas at Austin. His first wife, Edna Maynard Gott, passed away in 1986; their two children are Eugene Willard Gott and Edith Suzanne Gott. After his retirement from Texas Tech University in 1989, he married Orene Whitcomb Peddicord, M.D. on 14 May 1991 and they lived in Odessa, Texas.

Preston joined the Texas Tech University (TTU) faculty in 1948 and taught physics and astronomy there for 41 years, before retiring in 1989. He was responsible for starting astronomy teaching within the Physics department. He also developed, and taught for many years, a very popular, hands-on photography course in that department.

It is due to Preston's persistence and determination that TTU has two astronomy observatories devoted to teaching. Because of his efforts, the on-campus observatory, Igor, was donated to TTU by White Sands Proving Grounds, New Mexico. He is also primarily responsible for obtaining the land, equipment and construction funds for an off campus observatory. In 1991, the TTU Board of Regents named the latter facility the Preston F. Gott Skyview Observatory. He also developed a private Mountainside Observatory in Fort Davis, Texas.

Until recently, Preston was listed as a Senior Scientist at NASA's Jet Propulsion Laboratory in Pasadena, CA where he worked several summers on the moon and mars lander projects. In the 1950s and 1960s, he worked several summers at the White Sands Proving Grounds in New Mexico. In that period, he was also a consultant and frequent Visiting Scientist at the Aberdeen Proving Ground in Maryland.

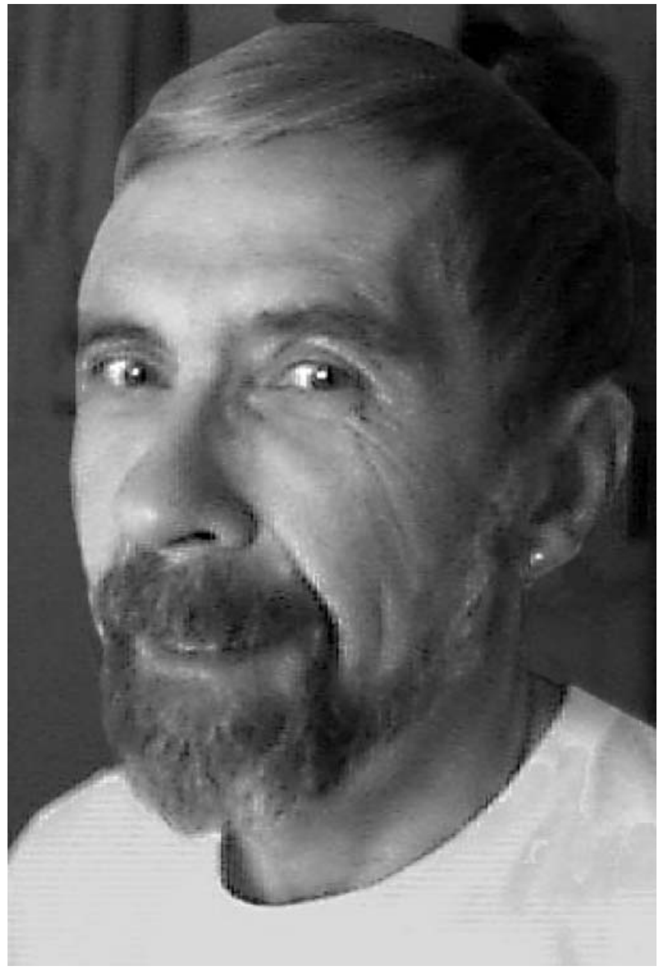
Preston was a very generous donor to the Department of Physics and the Texas Tech University. He endowed the Gott Gold Tooth Scholarship Award in Physics and also endowed a scholarship in the Women's Studies Program, in memory of his first wife, long time TTU Economics Professor Edna Gott. He was a true gentleman and a friend to all who knew him. He will be sorely missed. He is survived by his wife, Orene, and his children, Eugene and Suzanne. His stepchildren are Ruth, Benita, and Diana (who pre-deceased him).

Charles W Myles
Texas Tech University

GARY LARS GRASDALEN, 1945–2003

With the passing of Gary Grasdalen on 20 April 2003 the astronomical community has lost one of its most creative members. Born in Albert Lea, Minnesota on 7 October 1945 to the farming family of Lars G. and Lillie Grasdalen, Gary developed a strong childhood interest in science, and a particular fascination with astronomy. In 1964, he entered Harvard College intending to pursue those interests. During his freshman year, Gary enrolled in an undergraduate research seminar in which he first displayed the combination of keen insight and imagination in applying new techniques that was manifest throughout his professional career. In 1968, he published his first two papers—studies of the C^{12}/C^{13} ratio in metal deficient stars, and of Fe I and Fe II transition probabilities—which summarized research carried out during his junior and senior years at Harvard. Grasdalen next entered the astronomy graduate program at the University of California, Berkeley. There he developed a strong interest in the early stages of stellar evolution and, in particular, the potential of S-1 image intensifiers and newly available near-infrared detectors to detect and analyze the stellar populations embedded within their parent molecular cloud complexes.

Following award of his PhD in 1972, Grasdalen was appointed to the staff at the Kitt Peak National Observatory. Early in his career at KPNO, Gary developed tools that enabled routine near-infrared mapping of nearby molecular cloud complexes, most notably the telescope control programs that enabled precise raster scanning of these regions. Those same programs were some of the many innovations in which Gary had a hand. These innovations enabled a generation of KPNO observers in the 1970s to fully exploit the power of the newly commissioned Mayall telescope as well as the smaller telescopes on Kitt Peak.



Gary Lars Grasdalen

In 1973, he published the first map of the central region of a molecular cloud, which revealed an extensive embedded, optically obscured population of newly formed stars in the Ophiuchus complex. This discovery led to a series of survey papers cataloging and describing the young stellar population associated with multiple nearby clouds. The results from these early survey papers produced finding lists and nomenclature for embedded young stars that are still referenced by researchers.

By developing the tools needed to point telescopes precisely, Grasdalen was able to follow a hunch that he had while a graduate student at Berkeley—that Herbig-Haro objects were excited by optically obscured young stars that were displaced from these emission nebulae. He believed these objects to be reflection nebulae, scattering light earthward from a young star whose powerful wind had carved out a cavity thus creating an indirect pathway for optical photons to reach observers from an otherwise invisible star. Grasdalen compiled a list of candidate H-H objects from the Palomar Observatory Sky Survey and began a near-infrared search for associated young stars, first using inefficient PbS and when they became available, InSb detectors. In 1974, his insight was rewarded with the discovery of the embedded young star associated with H-H 100 in Corona Austrina, and soon thereafter, with multiple candidate infrared sources associated with H-H objects. The 1974 discovery paper notes that the exciting source for H-H 100 is located near the geometric center of a 0.1 pc, roughly spherical cloud, providing early evidence that young stars form within regions that we now call ''molecular cores.'' Following several years of study, it became clear that the H-H objects themselves are in fact directly excited via stellar wind-molecular cloud interactions, thus invalidating the hypothesis that H-H objects are pure reflection nebulae. Nevertheless, Grasdalen's pioneering discovery of infrared sources associated with these objects, combined with the infrared survey results, led to a veritable explosion of infrared and molecular line studies of star-forming regions.

Grasdalen was also a major contributor to early attempts to understand the nature of intermediate mass young stars - the Herbig Ae/Be stars. His work demonstrated both their pre-main sequence nature via surface gravity measurements and that these objects share infrared properties in common with their lower mass counterparts.

Results from these studies were summarized in a review published in *Annual Reviews of Astronomy and Astrophysics* in 1975. This was an early attempt to provide a comprehensive overview of star-formation in molecular cloud complexes and to link the emerging results from mm-wave and infrared observations. Perhaps as noteworthy as the overview was his introduction of the term ''Young Stellar Object'' or YSO. In part, this term was invented by Grasdalen as a reaction to the term ''QSO,'' which in those days (and indeed today) seemed to create an aura of mystery, seductive both to the public and the astronomical community; we star-formation types hoped that YSO would do the same for our field!

In 1978, Grasdalen left Kitt Peak for the University of Wyoming where, along with Bob Gehrz and John Hackwell, he made the Mt. Jelm 2.1-meter telescope a world-leading facility for infrared studies. His research interests evolved to include, in addition to YSO research, infrared spectroscopic study of novae, a field that he, Gehrz and Hackwell pioneered and which Bob Gehrz has carried forward, creating an impressive and important oeuvre. Grasdalen was a mentor to a generation of graduates from the University of Wyoming including Kathleen deGioia-Eastwood, Matthew Greenhouse, Karl Klett, Gregory Sloan, Jill Price, Michael Castelaz, Craig Gullixson and Thomas Hayward. To a person, they spoke to the high standards he set, his constant expectation of excellence and critical thinking, the amazing range and depth of his knowledge, and his incredibly creative mind.

Following important and influential service on the Optical-Infrared panel for the 1990 decadal survey, Gary left the University of Wyoming and, for awhile (and much to our collective loss), astronomy. Gary was a very private and, in many ways, a wary person. His decision may have been linked to a need for a break from a lifetime of pressure. In the early 1980s, Gary acknowledged that he was gay, a fact which for years he carefully hid from his friends and colleagues. While he found much support at the University of Wyoming (and elsewhere), both subtle and rampant homophobia had to have an affect on someone who was both unusually sensitive and filled with self-doubt. With increasing frequency, whatever Gary may have felt deep within led to bouts of self-destructive behavior. At least it seemed that way to his friends and colleagues; to him, it may have been release. A sad consequence was his contracting AIDS.

During the 1990s, Gary ran a non-alcoholic bar in Denver, and according to some, was at relative peace. Apparently, his love for astronomy was still deeply felt and he ultimately returned to work during his last years at the Jet Propulsion Laboratory's Table Mountain Observatory. There, he once again brought his expertise in telescope control systems to bear to upgrade the observatory and enable tracking of rapidly moving objects. He continued to work at Table Mountain until a few weeks before passing away from complications associated with AIDS.

We will miss his acid, sometimes black humor, his enjoyment of a stimulating argument, his seemingly off-the-wall, but always, in retrospect incredibly insightful comments. He accomplished much and, perhaps had he found peace and acceptance earlier, could have accomplished so much more.

His two sisters, Lavon Engen of Naples, Florida and Janet Stallerin of Albert Lean, Minnesota, survive Gary.

Stephen E. Strom
National Optical Astronomy Observatory

JESSE GREENSTEIN, 1909–2002

On the 21 October 2002, with the death of Jesse Greenstein, many of us in astronomy lost a beloved adopted father and astronomy lost one of its most influential leaders of the postwar era. Truly a giant is gone; it is easy to say that they don't make the likes of Greenstein, Spitzer, and Scharwarzschild any more, but it is unfortunately only the truth. The field has changed and grown enormously in the more than 50 years spanned by Jesse's career with no small part of this traceable directly to his efforts.

His growth was shaped very much by world events. He enjoyed a quite comfortable childhood; he was born on 15 October 1909 to successful immigrant parents, Maurice and Leah, who indulged his early interests in astronomy, radio, and science in general; these interests were to remain with him the rest of his life. As a boy he thought physics dull and chemistry exciting, though later he was to be influential in the transformation of astronomy into astrophysics in this country. He was something of a prodigy, entering the Horace Mann School for boys (an excellent private high school) at age 11 and Harvard at age 16 (in 1926). He met and became close friends with Cecilia Payne, with whom he shared cultural and scientific passions. She was certainly the greatest female astronomer of the era but largely shunned and ignored by her colleagues. Thus began a curious ambivalence in his relationship with women in the field; in fact and in action he was highly supportive but much less so in word. He graduated with a BA in astronomy in October 1929, on the eve of the stock market crash. He stayed for one more year and obtained a Master's degree, prevented by ill health from a planned one-year visit to Oxford.

His family had always assumed that he would forego his interest in research and take his place in the family's successful business and real estate endeavors and the seriousness of the market collapse impelled him, very much against his will, to do just that. He proved himself to be a capable manager, able to deal with difficult times and circumstances,

Jesse Greenstein
Photo copyright California Institute of Technology

and the family business prospered. However, his itch to be an astronomer did not falter, and in 1934, when he was convinced that the family business would survive without him, he returned to Harvard - over the objection of director Harlow Shapely who tried to persuade him that the field had advanced too far in his four-year absence for him ever to catch up!

This same year he married his childhood sweetheart Naomi Kitay, whom he ever after affectionately called 'Kitty.' Naomi nourished the already-strong humanist streak in Jesse. Interested in, and passionate about, art and the theater, life in general, and whatever it was that absorbed her interest at the moment, she was a wonderful foil for Jesse's self-deprecatory and sometimes depressive moods. She died a few months before Jesse did; they had been married 66 years.

At Harvard he pursued a very successful and prescient thesis on the scattering of light by interstellar grains, begun perhaps partly in an endeavor to alleviate his failure during a Master's research project to recognize the existence of dust absorption and reddening in the face of quite convincing data. His last days at Harvard were premonitory of things to come in his career. He and Fred Whipple wrote a paper attempting, quite unsuccessfully, to explain Karl Jansky's detection of strong radio emission from the center of the Galaxy as thermal emission; this was long before the existence of magnetic fields and relativistic electrons were even suspected. The problem was to wait 15 years for a solution. But Jansky's, and later Grote Reber's, observations resonated with Jesse's early interest in radio and presaged his later decisive support for radio astronomy in the U.S.

In 1937 he was awarded a NRC fellowship, which he took to Yerkes Observatory. Attracted by the innovative and productive group assembled there by Otto Struve, he flourished. Still working on dust and the interstellar medium, he began a long and productive collaboration with theorist Louis Henyey. He also began his career in stellar spectroscopy at Struve's urging and did the first analysis of the peculiar hydrogen-poor object upsilon Sagittarii, thus beginning a love affair with peculiar stars and their compositions which was to last the rest of his career.

During the war he and Henyey, as well as a number of other astronomers, managed to stay at Yerkes, largely putting aside astronomical research to work on the war effort. He and Henyey learned optics in the face of great difficulty (modern optical design techniques at the time being almost exclusively both proprietary and German) and produced many optical designs for the military, among which is the beautiful wide-angle, Henyey-Greenstein camera.

After the war Jesse became very interested in, and supportive of, the vast changes to the field wrought by the technological developments during the war, including infrared detectors, photomultipliers, sensitive radio receivers, and rockets. Astronomy clearly stood on the threshold of a new and wonderful era, which he was determined to help usher in.

The astronomical community had already recognized Jesse's genius and in 1948 he received an invitation he could not possibly refuse. He was invited to come to Caltech to build a department to do science with the soon to be completed 200-inch Hale telescope, by far the largest and most ambitious telescope project to that date. The family (there were now two sons, George and Peter) moved from the little town of Williams Bay, Wisconsin to the bustle of postwar Pasadena, California. One may well ask whether anyone, given an opportunity of this magnitude, could have failed to be great but the answer, I am certain, is that it would have been very easy indeed. It took all of Jesse's hard-won ability as a manager, his wonderful personal touch, his ease with moneyed supporters, and above all his unimpeachable scientific and personal integrity to build what is universally recognized as one of the finest departments in the world. The arcane political arrangements with the Carnegie Institution, which ran Mount Wilson and would later run both Mount Wilson and Palomar jointly with Caltech, were hammered out with Jesse's guidance before he had a chance to build the department. In the beginning the only two astronomers at Caltech were Jesse and Fritz Zwicky; Zwicky was a genius but personally incredibly difficult and Jesse was very much alone in navigating the difficult political waters.

His view of the way to build the department, which time has certainly vindicated, was to hire the best international theorists he could find. He was convinced they were the smartest people being trained at that time and convinced as well that the lure of the great telescope would transform them into capable observers who would soon understand their data from an astrophysical perspective. This was wildly successful. He built a postdoctoral program around stellar abundance determinations, funded by the Air Force and aided by the many military contacts he had made during and after the war. He managed, in his tiny department, to lure the most able students in the field. The list of names among the early students and the ''graduates'' of the abundance project is a who's who of astronomy: Allan Sandage, Helmut Abt, George Wallerstein, Halton Arp, Wallace Sargent, Leonard Searle, to name only a representative few.

His own research continued unabated; he returned to the subject of dust with Leverett Davis and, in 1951, they proposed the magnetic alignment mechanism to explain interstellar polarization that survives essentially unchanged to the present - certainly one of the longest-lived theoretical results in the field. At Caltech's Kellogg Radiation Laboratory, there was much interest in the nuclear reactions that provide stars their energy and potentially result in observable abundance changes. This work fit hand-in-glove with Jesse's interest in stars of peculiar abundance and he forged close scientific ties with the Kellogg team, particularly Willy Fowler. Jesse arranged a controversial visit to Caltech by Fred Hoyle (Hoyle's steady state cosmology was not popular among Caltech physicists) and Hoyle's protégés Geoff and Margaret Burbidge. Their classic work with Fowler on nucleosynthesis arose from this visit. Later his research turned increasingly toward understanding the denizens of the lower left of the Hertzsprung-Russell diagram - white dwarfs, blue subdwarfs, and nuclei of planetary nebulae. He became the observational authority on such stars, and much of our current understanding of these objects is a direct outgrowth of his work. In the course of this work he obtained several spectra of faint blue objects with weak, broad emission lines that were not readily identifiable. The realization that compact stars could have very strong magnetic fields was then current, and he felt that most of these objects could be explained by peculiar Zeeman and pressure effects on the spectra of intrinsically faint degenerate objects. The quasar story has been told many times, but the realization by Maarten Schmidt in 1963 that the spectrum of 3C273 was consistent with a redshift of 16 percent led them to reassess Jesse's work on 3C48, a quasi-stellar radio source with a spectrum similar to some of the peculiar blue ''stars'' in his library of spectra: this turned out to be the second QSO redshift recognized, with a value of 0.37. In 1960, Jesse had obtained a spectrum of Ton 202, which he had confidently identified as a peculiar DC white dwarf 40 pc distant. When he went through his library of spectra with an eye toward new possibilities, it turned out to be a QSO with a redshift of 0.37, continuing his penchant for being right almost all the time, but with the occasional really spectacular mistake.

He characterized his research and the rather frequent and profound changes of direction in a very characteristic way - he very actively wanted to skim the cream off new subjects and establish correct directions for research, but he did not care for pedantic detail. It is clear from his record that this did not mean that he was ill equipped to dig deeply; his work on dust in particular was very difficult stuff. He simply felt that he had the tools at his disposal to help at the very frontiers of astronomical research and preferred to leave the details to others.

Even before he came to Caltech in 1948, Jesse was convinced by the work of Jansky and Reber, and later the British and Australians, that radio astronomy was of vast importance to the field, and he was determined that Caltech should be a center. He fought for the founding of a radio astronomy group by first gaining institutional acceptance - which was not easy - and then obtaining federal funding for the Owens Valley Radio Observatory (OVRO) in 1954 from the Office of Naval Research. In this context, it is important to note that astronomy in the U.S. had been, for a very long time, almost exclusively privately funded and the Caltech abundance project and the radio astronomy observatory were among the first large departures from this norm. Jesse's task was made even more difficult by the connection with the Carnegie Institution, which at the time had specific rules against seeking federal funds.

He gradually built Caltech astronomy into the powerhouse it has been for many years. Along the way he fostered and welcomed promising new technology, beginning with photomultipliers, through radio astronomy techniques, vidicons, CCDs, and computers. His views on computers as tools for doing theory, namely that they basically trivialize theoretical research (he would not have said it ''exactly'' that way) would certainly be very unpopular today.

Jesse's role on the national scene was profound and controversial. He was instrumental in persuading the Navy and Air Force to fund astronomical research and he was active in the founding of the National Science Foundation; he chaired the first NSF advisory committee in astronomy. He served on countless government advisory committees and worked with other Caltech physicists in highly classified research until well after such work became highly unpopular on campuses. He pushed very hard for the founding of the national observatories, particularly NRAO. He was one of the organizers of the conference in 1954, which was explicitly aimed at convincing the government to establish NRAO - the same year he obtained funds from the Navy to build Caltech's private OVRO, which was for a long time in direct competition with the national observatory. He was also influential in the founding of the national optical observatory at Kitt Peak, though this was to be a very contentious issue later. He was chosen in 1970 to lead the second National Academy decade review of astronomy, after the ground breaking Whitford report a decade earlier. It is generally conceded that the Greenstein report was the most successful of these efforts to date in the face of a rather austere funding climate; this effort was aided by the cohesive spirit of the community, but also because of the wisdom that he brought to the enterprise.

His view on the best way to conduct science was explicitly and very frankly intellectually elitist. The very best people at the very best institutions, he thought, should be supported to the fullest extent possible with money and technological support wherever it could be found. He had built the Caltech department from a gleam in George Ellery Hale's eye to one of the preeminent astronomical research institution in the world, and was proud of it. He felt that the nation owed it to science for its own sake and as a nation to support science fully. He wrote in his memoir, ''An Astronomical Life,'' in the *Annual Reviews of Astronomy and Astrophysics*: ''Human illness and poverty cannot be cured merely by spending money, but the human condition can be ennobled by spending money wisely.'' He did not think that spending vast amounts of money at Kitt Peak to build giant telescopes for the whole community was the best way to spend said vast amounts of money. He felt that the elite universities had demonstrated the ability both to build big instruments (the 200-inch, the 120-inch) and to attract the astronomical staff to operate them and to do superb science with them. If the federal government were to spend the money, it should clearly go to those universities. In any event, these universities should not be allowed to wither as the national observatories grew. Curiously, his view of NRAO was very different and he personally was enthusiastic about the construction of the VLA; indeed, it was the highest-priority project of the Greenstein report.

In any document such as this, one must mention offices and awards. Jesse was awarded and held most of them: the Gold Medal of the RAS, the Russell Lectureship, the Bruce Medal, the Vice Presidency of the AAS, a (controversial) chairmanship of AURA, membership in the National Academy, chairmanship of many of its, and other government, advisory committees as well as chairmanship of the decadal review. He held the first Lee DuBridge chair at Caltech. While he was appreciative of these awards, he felt that awards and honors usually came too late in a scientist's career to be useful.

He was a superb scientist and skillful manager and administrator, but no description of Jesse, especially this memorial one, can possibly be complete without some attempt to describe him as a human being. It was shortly before the QSO era, in 1961, that I, as a green graduate student, first met Jesse. I was in awe, of course, but it soon became clear that there was not even a stern exterior to this remarkable man who had built the Caltech department, and who was very much a personification of American astronomy. He cared deeply about everyone in his department and clearly prided himself as an amateur psychologist. He was always available, charming, warm, and open, and eager to discuss and help with personal problems as well as scientific ones with seemingly equal willingness and enthusiasm. Naomi was called in for help with stubborn personal problems and their house on San Pasqual street was a warm, inviting place and the location of countless formal and raucous informal parties and gatherings. I never worked with him directly as a student, but felt that I knew him better than any of the faculty with whom I did work. All of the words I have read in tribute to Jesse mention him as a father; he was certainly mine, and I (and all of his many children) will miss him terribly.

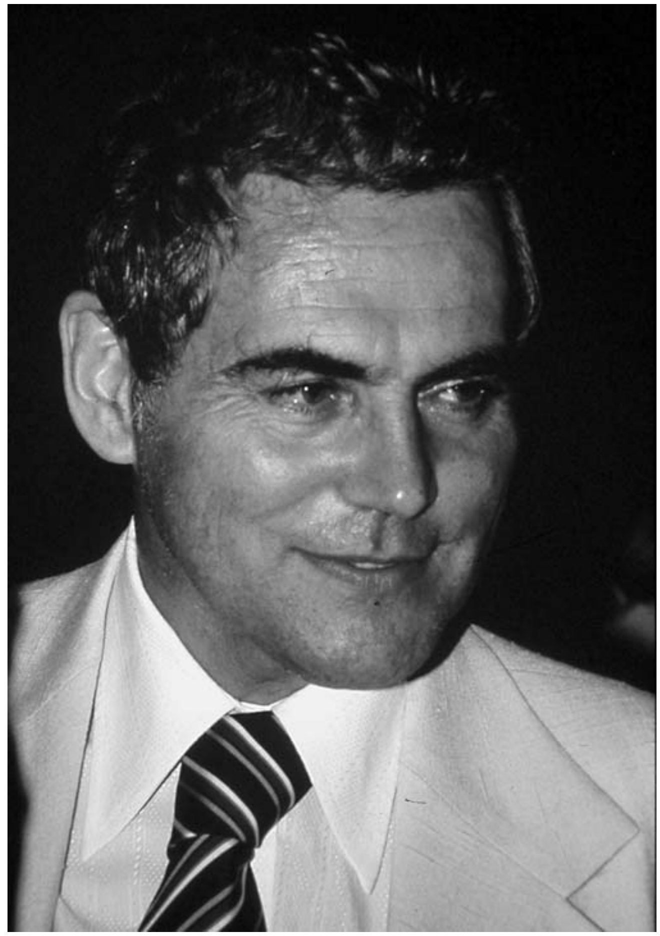
Jim Gunn
Princeton University

GERALD S. HAWKINS, 1928–2003

Public perceptions of human prehistory were transformed in the 1960s by astronomer Gerald Stanley Hawkins, who died suddenly and unexpectedly of a heart attack on 26 May 2003 at Hawkridge Farm, in Virginia, near Washington, D.C. His astronomical analysis of Stonehenge, first published in *Nature* on 26 October 1963, and subsequently developed and framed with historical and cultural context in a best-selling book, *Stonehenge Decoded* (1965, in collaboration with John B. White), was also showcased internationally at the time in a one-hour CBS television documentary special, *The Mystery of Stonehenge*.

The high-profile, unconventional, and cross-disciplinary character of Hawkins's celestial interpretation of Stonehenge alignments and his configuration of the monument as an eclipse predictor attracted archaeological skepticism that provided the controversy desired by the makers of the television program. Antagonism was contrived between Hawkins and archaeologist Richard J.C. Atkinson by the production team to introduce conflict that would enhance audience interest in the subject, and the televised dispute troubled both men for decades. By the early 1970s, however, Hawkins had inspired others to examine the astronomical potential of ancient and prehistoric monuments in many parts of the world. He ignited modern studies of archaeoastronomy. In fact, in a second book on the subject, *Beyond Stonehenge* (1973), Hawkins reported his expanding perspective with accounts of his fieldwork on New Kingdom temples in Egypt, on the giant geoglyphs near Nazca, Peru, and at other sites. He also brought the work of other investigators to the attention of his many readers. He established methods and protocols for alignment studies and invited others to use them.

Following, in a sense, the footsteps Sir J. Norman Lockyer left among the antiquities in the late nineteenth and early twentieth century, Hawkins reexamined the alignments of several Egyptian temples, documented significant weaknesses in Lockyer's analysis of the Great Temple of Amun Re at Karnak and formulated a new astronomical interpretation he supported with relevant hieroglyphic inscriptions. His field survey of the giant ground drawings near the Ingenio Valley in the south coastal desert of Peru, sponsored by the National Geography Society, convinced him that the geoglyphs are not astronomically oriented.



Gerald S. Hawkins
Photo courtesy of Ed Krupp

The impact of Hawkins's work also reached informal science education. Major planetaria in North America produced and presented programs that simulated ancient skies and immersed audiences in the alignments and events Hawkins had spotlighted. Archaeoastronomy evolved in response to his trailblazing inquiries and eventually commanded the interest of a variety of academic disciplines, including archaeology, anthropology, art history, history of religions, and more. Hawkins wrote two more books on this theme, *Mindsteps to the Cosmos* (1983) and *Stonehenge, Earth and Sky* (2004, with Hubert Allen). Altogether he wrote 11 books and his first book, *Splendor in the Sky*, appeared in 1961. During his career he authored 150 papers.

Born on 20 April 1928, in Great Yarmouth, England, Gerald S. Hawkins, like many professional astronomers, was allied to astronomy as a child. When he discovered astronomy in elementary school, he obtained books on it from the public library. In 1939, during World War II, he was relocated inland, along with many children living on the English coast, away from the German bombing. Settled in Nottingham for the war's duration, he joined the local astronomy club as a teenager and systematically observed meteors. He later attended Nottingham University, which granted him a Bachelor of Science in physics (1949). He also collected a subsidiary degree in mathematics from London University. Continuing his study at Manchester University, under Sir Bernard Lovell, he collaborated on the discovery of daytime meteor streams, and he received a PhD in radio astronomy in 1952. Two years later, he left England to accept a research position at the Harvard-Smithsonian Observatory in Cambridge, Massachusetts. He was also a Research Associate for Fred Whipple's Harvard Radio Meteor Project at Harvard University. Additionally, he was a Senior Associate with the United States Air Force Cambridge Research Laboratory, and from 1957 to 1969 he concurrently held an appointment as Professor of Astronomy and Chairman of the Department of Astronomy at Boston University. He became a U.S. citizen in 1965.

Gerald Hawkins served as Dean of Dickinson College in Carlisle, Pennsylvania, from 1969 to 1971, when his career trajectory transported him to the United States Information Agency, where he was appointed Science Advisor to the Director and where he remained until his retirement in 1989.

Frederick Hawkins, the father of Gerald S. Hawkins, was an accountant. He died when Gerald was three years old, a casualty of aggravation of a wound he had endured during World War I. Gerald's mother, Anne Lillian Hawkins, was a Town Official in Great Yarmouth.

In 1955, Gerald Hawkins wed Dorothy Barnes. The couple had two daughters, but the marriage ended in divorce. In 1979, Hawkins married Julia Margaret Dobson, who survives him.

Hawkins enjoyed academic, professional, and commercial success and was also honored for his work. He received the Shell Award for Distinguished Writing in 1965 and additional recognition from the National Academy of Sciences and the Smithsonian Institution. A member of the prestigious Cosmos Club of Washington, D.C., which salutes intellectual achievement, especially in science, he was recruited frequently for public lectures by many organizations and institutions. He was a member of the Historical Astronomy Division, a Division Affiliate member of the American Astronomical Society and a member of the International Astronomical Union's Commission 41.

Gerald S. Hawkins was a colorful, articulate, and pioneering investigator who modeled a research profile in archaeoastronomy through innovative fieldwork. He induced many others to study ancient and prehistoric astronomy and is acknowledged for his essential and foundational role. His initiative propelled archaeoastronomical research into maturity. The Sherlock Holmes deerstalker cap he wore in the field when investigating standing stones and stone circles in Scotland advertised his attraction to scientific mysteries and his commitment to their solution. He persuaded many that part of the neolithic and bronze age intellectual heritage could be extracted from the unwritten record.

Edwin Krupp
Griffith Observatory

THEODOR SIEGUMFELDT JACOBSEN, 1901–2003

Theodor Jacobsen, oldest member of the American Astronomical Society, died in Seattle on 17 July 2003 at the age of 102. His astronomical career, which began in the 1920's, coincided with the rise of astronomy in the University of Washington from a one-man activity within mathematics to today's major astronomical department of more than 30 faculty and other research personnel.

Born on 6 February 1901 in Copenhagen, Denmark, he immigrated with his parents, brother and three sisters to the USA in 1917. Even while he was still in Denmark, his interest in astronomy was sparked at age 7 by a gift from his parents of a two-inch telescope. As early as 1921, in the midst of his undergraduate studies in chemistry at Stanford, he wrote to Director W. W. Campbell of Lick Observatory, inquiring how he should prepare for a career in astronomy and whether one could make a living at it. Campbell encouraged him to learn as much physics and mathematics as possible with the outcome that, on completion of his BA degree at Stanford, Jacobsen became a University of California Berkeley graduate student and was appointed a Lick Observatory fellow in the period 1923 to 1926. Following completion of his PhD thesis, entitled ''A Redetermination of the Radial Velocity Curves of Certain Cepheid Variable Stars'' (LOB, 379, 1926), he was appointed as ''assistant'' at Lick, a position roughly equivalent to that of ''instructor'' in a modern University environment.

Inquiries concerning whether Lick could recommend ''a promising young man to take over teaching some astronomy

Theodor Siegumfeldt Jacobsen
Photo courtesy of University of Washington

and math'' from then President Spencer of the University of Washington were received by Lick's acting director Robert Aitken in 1928. They were looking for a Berkeley PhD, said Spencer, and Aitken responded with an enthusiastic recommendation of Theodor Jacobsen, who then took up his duties in Seattle with the beginning of the fall term 1928. Jacobsen succeeded H. Zanstra (of Zanstra mechanism fame) in the Dept. of Mathematics, but it was not until 1948 that astronomy was split off from mathematics, at which time Jacobsen became chair and sole member of the new Astronomy Department. During the World War II years, he taught navigation to the recruits who moved on to become naval officers. In the postwar years, he taught elementary astronomy, as well as more advanced courses in practical astronomy, the kinds of subjects found in Smart's *Spherical Astronomy* text including celestial mechanics and observational work using the UW Observatory transit instrument. He chaired the Astronomy Department until 1965 when the Department began to undergo its modern expansion; he formally retired in 1971.

Jacobsen's post-thesis research continued to center on the determination of radial velocities of cepheids as well as binary stars and he maintained connections on a modest scale with the Dominion Astrophysical Observatory in Victoria, B.C. In this era of emphasis on galaxy evolution and cosmology, it is easy to forget that in the 1920s, there was still controversy over the nature of cepheids—were they pulsating stars or merely some form of odd binary? Jacobsen's extremely accurate radial velocity curves of these stars, when combined with then newly emerging accurate light curves, did much to bolster the pulsation hypothesis. According to astronomers currently working in the field, Jacobsen's 1926 velocity curves, obtained with the then state-of-the-art Mills spectrograph attached to the Lick 36-inch refractor, attained an impressive accuracy in the gamma velocities of these cepheids of about 100 m/s! His last paper on cepheid velocities was a joint publication in 1992, written when Jacobsen was more than 90 years old.

He also was a major contributor to the study of the ''level effect,'' a term applied to the fact that during the pulsation cycle, the radial velocity curves differ depending upon the spectral line formation depth within the cepheid atmospheres. The effect was recognized as a result of the passage of a running wave, again a manifestation of the pulsation phenomenon in cepheids.

Although the astronomy of stars was Jacobsen's main focus, he was a man of many interests. He had a love of the mountains, especially the nearby Cascade Range. He was especially fond of one-day hiking trips around and on the flanks of Mt Rainier, although he never attempted the strenuous climb to the summit. But some of the lesser summits of the Cascade range were among his trophies: Mt Hood in the late 40s, and Mt St. Helens in the 30s when because of its graceful symmetry, it was known as the ''Fujiyama of the West.'' He was also an accomplished pianist, his tastes running from Beethoven to the early romantics such as Schubert and Chopin. In many ways, his pianistic philosophy paralleled his personal attitudes about doing astronomy. For him, precision and clarity took precedence over lofty grand strategies. He was happy to make what he called modest additions to astronomical research, standing as it were, ''on the shoulders of others.'' Along with this, he would lament over, for example, how difficult it was to make the last movement of Beethoven's Op. 27, No. 2 clear—to make it effective, he would say, you have to pay attention to the details, just as doing good astronomy meant paying attention to the details.

Jacobsen married Evelyn Brandt a well-known Seattle piano teacher. They kept Welsh Corgi dogs, which they named for various famous astronomers. Theodor and Evelyn played together at facing grand pianos, sometimes works for duo piano, sometimes piano concertos with the orchestral part in piano transcription. All this came to an end in 1993 when Evelyn died after 40 years of marriage. They had no children.

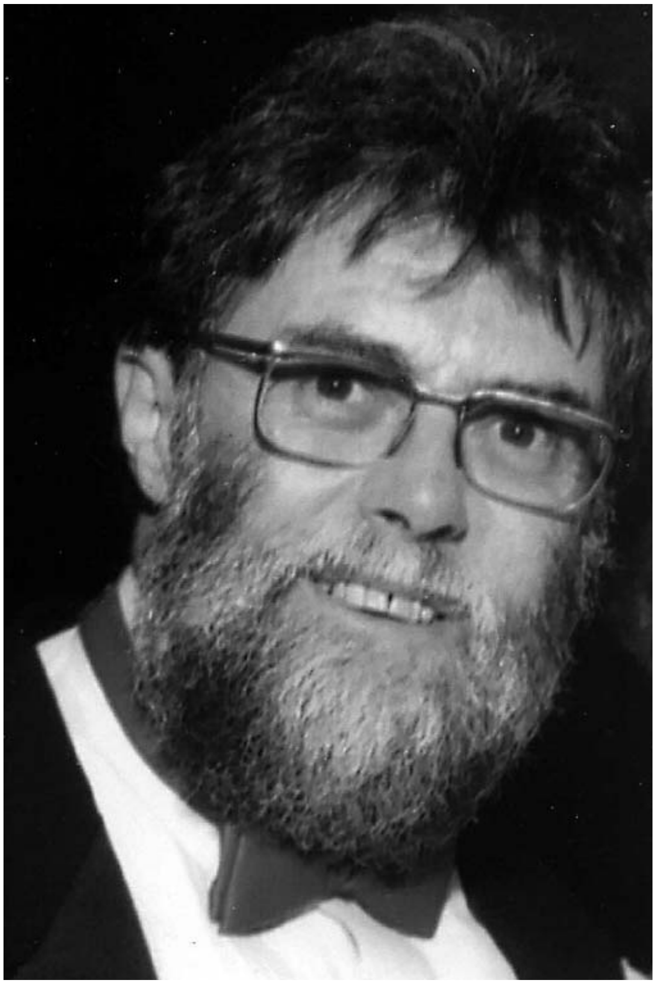
Jacobsen remained interested in classical astronomy—that of the Greeks and Arabs—as a kind of hobby during his entire life. But it surprised some members of the UW astronomy faculty when they found, on visiting Jacobsen in his home in the mid-90s, an extensive manuscript that he had composed using modern mathematics to rederive the laws of planetary motions as conceived by the ancients using far more primitive means. With the help of these and other colleagues, he was able to publish, at the age of 98, a UW Press book entitled ''Planetary Systems from the Ancient Greeks to Kepler.''

Robert P. Kraft
Lick Observatory George Wallerstein
University of Washington

LUDWIG FRIEDRICH OSTER, 1931–2003

Ludwig Friedrich Oster died at the Anchorage Nursing and Rehabilitation Center in Salisbury, MD on 28 February 2003, of complications from advanced Alzheimer's disease. He is survived by his wife Cheryl M. (Oroian) and his two children by a previous marriage, Ulrika and Mattias Oster. He had a distinguished career both as a researcher in solar physics and as a science administrator in the National Science Foundation.

Ludwig was born on 8 March 1931 in Konstanz, Germany and emigrated to the U.S. in 1958, acquiring American citizenship in 1963. His mother and father were Emma Josefine (Schwarz) and Ludwig Friedrich Oster. He got a BS degree in physics at the University of Freiburg under the guidance of Prof. K. O. Kiepenheuer in 1951, and a MS (1954) and PhD from the University of Kiel in 1956 under the guidance of Prof. A. Unsold. From 1956 to 1958 he was a Fellow of the German Science Council at Kiel and, upon his arrival to the US in 1958, he became a Postdoctoral Research Associate in the Physics Department of Yale University. He became an Assistant Professor of Physics and Astrophysics at Yale in 1960 and five years later he was promoted to Associate Professor. In 1967 he became an Associate Professor of Physics and Astrophysics at the University of Colorado and a Fellow of the Joint Institute for Laboratory Astrophysics; he was promoted to Full Professor in 1970. In 1981 he was a Visiting Professor at Johns Hopkins University, and shortly thereafter became a National Research Council Senior Associate at NASA/Goddard Space Flight Center in Greenbelt, MD,



Ludwig F. Oster
Photo courtesy of Sabatino Sofia

where he worked on solar variability. He joined the National Science Foundation in 1983, where he became the Program Manager for the National Radio Astronomy Observatory in the Division of Astronomical Sciences of the Foundation; he remained there until his retirement in 1996.

His early work, started in Germany and continued at Yale, concerned radiation mechanisms related to solar phenomena. His works on cyclotron radiation, plasma oscillations and bremsstrahlung radiation have become classic publications in plasma physics and they continue to be referenced in the current literature. During this period he started his student mentoring work that led to the awarding of several PhD degrees.

At Boulder, he extended his work on solar and plasma physics to the newly discovered quasars and pulsars. He loved to study and understand the mysterious and the puzzling phenomena, which the Universe so generously provides.

While at Goddard, he joined the effort to understand the variations in total solar irradiance then recently discovered by the Nimbus 7 satellite and the ACRIM experiment on the SMM satellite. He made significant contributions to that problem, particularly regarding the ultraviolet radiation component, and continued to work on it after he had joined the NSF as a science administrator. He published his last scientific paper in 1983, after having joined NSF.

Ludwig was a great teacher and an even greater friend. He taught courses including electromagnetic theory, relativistic theory of radiation, quantum mechanics, solar physics and radio astronomy among others. He wrote an introductory textbook in astronomy that was translated into several languages. He directed PhD theses in a variety of topics. Best of all, he instilled in his students a sense of curiosity and confidence that lasted for a lifetime. He used to say, ''if what you think disagrees with the opinion of well-known astronomers, do not simply assume that you are wrong and they are right. It may well be that you are right! Think carefully about it.'' That advice has served all of us, his former students, well. We will miss his cheerful disposition, his friendliness, and his neverending curiosity.

Sabatino Sofia
Yale University Department of Astronomy
Martin D. Altschuler
Radiation Oncology, Philadelphia, PA

DIANNE K. PRINZ, 1938–2002

Dr. Dianne Kasnic Prinz died 12 October 2002 at the Hospice of Northern Virginia after a long struggle with lymphatic cancer. She worked for over 29 years until retirement at the Naval Research Laboratory in Washington, DC on sounding rocket, space shuttle, and satellite experiments to observe the Sun at ultraviolet wavelengths from space.

Dianne Prinz was born 29 September 1938. She received her BS degree from the University of Pittsburgh in 1960, and a PhD in Physics from Johns Hopkins University in 1967, where she was a University Fellow 1960–1964 and a Gilman Fellow 1960–1963. She was a Research Associate in the Physics Department of the University of Maryland 1967–1971 and, from 1971 until her retirement in February 2001, she was a Research Physicist at the Naval Research Laboratory (NRL). At the time of her retirement she was Head of the Solar Radiation Section, Solar Physics Branch, Space Science Division of the Naval Research Laboratory and was supervising the work of a team of scientists that was operating the SUSIM (Solar Ultraviolet Irradiance Monitor) experiment on the UARS (Upper Atmosphere Research Satellite) spacecraft as well as reducing and analyzing the observations.

Dianne was a member of the Washington Academy of Science (elected 1976 and Fellow 1987), served as Vice President of the National Capital Section of the Optical Society of America (1976), and received the Navy Award of Merit for Group Achievement (1985), the NASA Public Service Group Achievement Award (1987), and the Navy Meritorious Civilian Service Award (2001). Her professional memberships included the American Astronomical Society and its Solar Physics Division, the American Geophysical Union, and Sigma Xi. She had over 60 publications in her scientific bibliography.

Early in her career at NRL, Dianne developed a Lyman alpha spectroheliograph sounding rocket payload. Launching at White Sands Missile Range in 1972, she obtained high spatial resolution (for that day) full disk solar images. Her

Dianne K. Prinz
Photo courtesy of the Naval Research Laboratory

published analysis was pioneering for the study of the Lyman alpha irradiance and established the range of brightness of solar active regions relative to the quiet disk.

Dianne also had a keen interest in understanding how the upper atmosphere responds to changing solar conditions, a field of research now called ''space weather.'' Early in her career she collaborated with NRL scientists Robert Meier and Phillip Mange on the analysis of some of the first satellite remote sensing observations of the atmosphere and ionosphere. That work laid the foundation for many future NASA and DoD space weather programs, and throughout the years she continued to participate in the design of atmospheric remote sensing instruments that are flying in space today.

In 1978 Dianne was selected by NASA to train as a Payload Specialist astronaut to operate the solar instruments that were to fly on the Spacelab 2 mission aboard the Space Shuttle. From a group of four in training (the others were Drs. J.D.-F. Bartoe, Loren Acton, and George Simon), Bartoe and Acton were finally selected and flew on the Spacelab 2 mission in 1985, when Dianne served as mission communicator with the Payload Specialists. She and Simon were due to fly on a planned follow-up second flight but the aftermath of the explosion of the Challenger Space Shuttle shortly afterward led to cancellation and the end of this phase of her career. In addition to the scientific aspects of her work, she made a substantial effort to communicate her enthusiasm to the public. After the Spacelab 2 mission she often gave presentations to adult and student audiences on her experiences, sometimes bringing along her flight suit. She received letters from all over the world from correspondents who had read of her role.

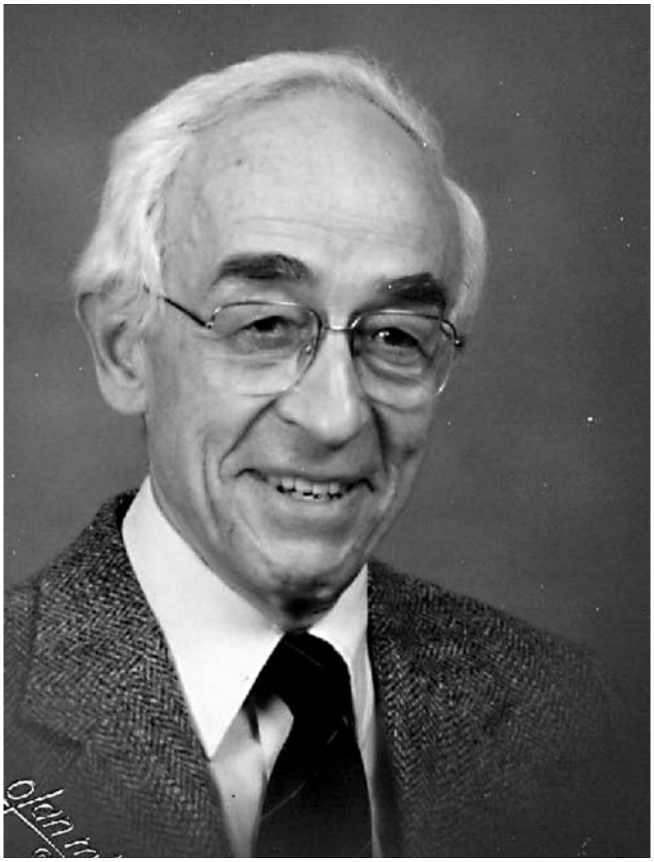
Dianne was a member of the team at NRL that developed the requirements for a new instrument to accurately monitor, over many years, the solar ultraviolet irradiance, which was known to vary considerably and is a crucial input to many processes in the Earth's upper atmosphere. It was critical to overcome the challenge of maintaining the absolute calibration of an ultraviolet spectrometer. The new instrument, called the Solar Ultraviolet Spectral Irradiance Monitor (SUSIM), was flown first on an early Space Shuttle flight (STS-3) and next on the NASA Spacelab 2 mission, for which she had trained as an astronaut payload specialist. The SUSIM design was then revised for a long-term flight aboard the Upper Atmosphere Research Satellite (UARS). After the launch in 1991 of the UARS SUSIM, she led the NRL team that ran the UARS SUSIM flight operations and developed the data analysis software. After the death of Guenter Brueckner, she became the Principal Investigator of UARS SUSIM and continued the operation, analysis, and publication of these critical scientific observations. To determine the SUSIM absolute calibration, careful studies were performed to separate the degradation of the instrument response from the true solar variability. Extensive work was necessary to model the degradation of the instrumental sensitivity with time, the stray light correction, the field-of-view correction, and the wavelength scale. Dianne managed these tasks and produced a long term, well-calibrated history of solar ultraviolet irradiances over the full activity levels of a solar cycle.

Dianne grew up on a farm in southwestern Pennsylvania, the daughter of Joseph J. Kasnic, a steel worker and part-time farmer, and Anna M. Kosyrich Kasnic, a homemaker, part-time teacher and accomplished artist and musician. Diane will be remembered for her deep love of animals, whether her beloved horse Chesterfield or stray or hungry cats in her neighborhood. Her marriage to Dr. Gary Prinz ended in divorce. She is survived by her sister and brother. Diane had an early interest in science and, throughout her career, worked as an experimental physicist and designer of optical instrumentation. She was a pioneer in her interests in space science, and usually overcame the obstacles she encountered in her field and at a time when she was often the first woman in authority encountered by male co-workers. She had a no-nonsense attitude in her work relations, but inspired the friendship of colleagues through her genuine good will, competence, and utter lack of pretension.

J.W. Cook and R.A. Howard
Naval Research Laboratory

HARRISON EDWARD RADFORD, 1927–2000

Harrison Edward ''Harry'' Radford, a noted laboratory spectroscopist and pioneer in the application of magnetic resonance techniques to spectroscopy, died on 5 May 2000, after a long battle with amyotropic lateral sclerosis (ALS). During a 37-year career at the National Bureau of Standards and the Smithsonian Astrophysical Observatory, Harry mea-



Harrison Edward Radford
Photo by Olan Mills

sured the frequencies of numerous molecular transitions which aided the emerging field of astrochemistry.

Harry was both an excellent theoretician and a preeminently skilled experimentalist. He has several major spectroscopic achievements to his credit. He performed the first study of a short-lived molecular free radical, OH, by electron paramagnetic resonance spectroscopy, opening up a huge and important field of research. Together with colleagues he made the first observation of the rotational spectrum of CH by far infrared laser magnetic resonance spectroscopy and extended the technique to other molecules such as CH_3O.

Harry was born in Peterborough, New Hampshire, on 26 July 1927. He was the son of Harrison Edwin Radford, a roofer, and Dorothy (née Cole) Radford. He dropped out of high school to join the Navy in 1944 as an electronics technician's mate. After his discharge in 1946 he worked in the family construction business for four years as a roofer. In 1950 he entered the University of New Hampshire and graduated four years later, Summa Cum Laude, with a degree in physics. As a graduate student at Yale from 1954 to 1959 he wrote his PhD thesis under the supervision of V.W. Hughes on the microwave Zeeman spectra of oxygen and fluorine where he used the technique of paramagnetic resonance absorption in atomic vapors. In 1954 he married Mildred Spofford. They had three daughters, Susan (born in 1955), Amy (1957), and Sarah (1960). In 1974 he married Alfa Goldthwaithe Morrison, who survived him.

From 1959 until 1969 Harry worked at the National Bureau of Standards (now the National Institute of Standards and Technology, NIST) in Washington DC. While there, he became interested in determining the long wavelength spectra and chemical properties of molecular free radicals, which can be generated in gaseous samples only in extremely low densities. He saw the potential for the application of magnetic resonance techniques to free radical spectroscopy early on. In 1965 he made the definitive measurements of the ground state lambda doublet transition frequencies of OH, which had recently been discovered in the interstellar medium. These measurements made it possible to determine the velocities of molecular clouds with high precision. For his work with the Bureau he earned the Department of Commerce's Silver Medal for Meritorious service.

In 1969 Harry moved to the Smithsonian Astrophysical Observatory (SAO) in Cambridge, Massachusetts where he remained until his retirement in 1992. He continued to do research for four more years, almost until the onset of his illness. He initially joined the group, under A.E. Lilley, that was formed to bring together laboratory spectroscopy and the fledgling field of radio astronomy of interstellar molecules. This interdisciplinary effort led to the discovery of several new molecules based on precise laboratory microwave measurements of their spectra, beginning with methanol, which helped to lay the foundation for the new science of astrochemistry.

While at SAO Harry pioneered the application of laser magnetic resonance spectroscopy to study the spectra of free radicals. His measurements of molecules such as OH, NH, CH, SO, HO_2, HCO, NH_2, N_2H_4, DO_2, DOCO, CH_3O, and CH_2OH informed and guided research in astrochemistry. He also applied this technique to the study of atmospherically important molecules. In recognition for his work he received the Senior Award of the Alexander von Humboldt Foundation in 1983.

Harry spent sabbatical years at Cambridge University in 1977, working with Douglas Russell, Brian Thrush, and Paul Davies. Additional sabbatical years were taken at the University of Bonn in 1983 (as a Humboldt Fellow) with Wolfgang Urban and at the MPI in Goettingen in 1993 with Friedrich Temps and Heinz Wagner. He was an active participant in the biennial International Symposia on Free Radicals for many years. In 1985, he was co-chair of the very successful meeting held in Colorado.

Harry's closest professional colleague and friend was Ken Evenson of the NIST Boulder Laboratories. Evenson died two years after Harry from the same form of ALS. They wrote many papers on laser magnetic resonance spectroscopy over a twenty-year period beginning in 1965. Harry often spent summers working in Boulder with Ken on various projects. They enjoyed hiking in the Colorado mountains. After his real retirement in 1996, Harry pursued various interests including German translation, computer tutoring, and art classes until the onset of ALS in 1998. Harry had an extensive interest in music. He played the Baroque recorder and participated for many years as a bass chorister at The First Church in Belmont, Unitarian, where his wife of 26 years, Alfa Radford, is the Music Minister. Harry was also a gifted craftsman and he built three harpsichords.

Harry was always a very easy and generous person to work with, a quiet, self-effacing scientist who let his work speak for him. He was fond of saying that every life leaves a residue. To his many scientific friends and colleagues, Harry's personal and professional ''residue'' is his experimental elegance and scientific excellence, tempered by humanity.

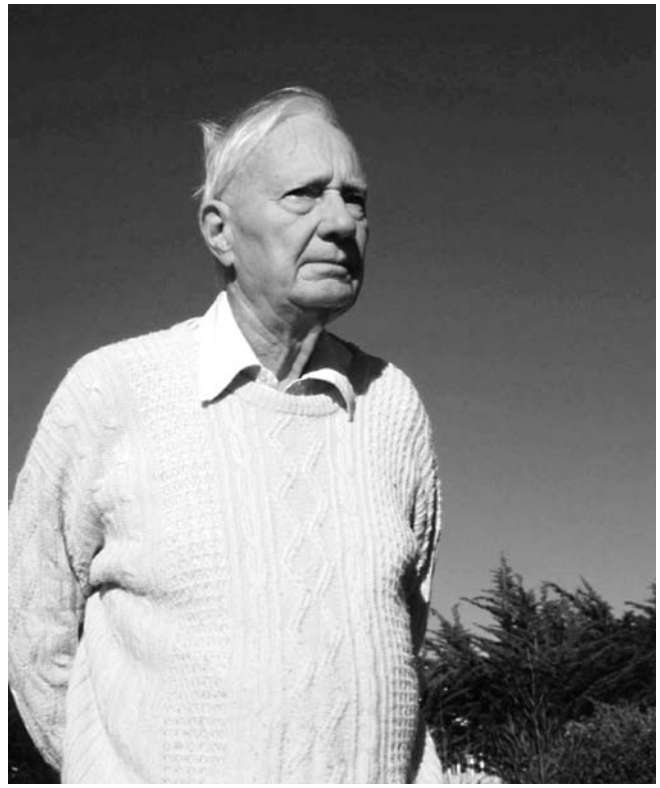
James Moran
Kate Kirby
Kelly Chance
John Brown Harvard-Smithsonian Center for Astrophysics and Oxford University

GROTE REBER, 1911–2002

Grote Reber, a pioneer of radio astronomy died in Tasmania, Australia on 20 December 2002, two days before his 91st birthday. Reber was born in Chicago on 22 December 1911 and grew up in the Chicago suburb of Wheaton, IL. His father, Schuyler Colefax Reber, who was a lawyer and part owner of a canning factory, died when Grote was only 21; his mother, Harriet Grote was an elementary school teacher in Wheaton. Among her 7th and 8th grade students at Longfellow School in Wheaton was young Edwin Hubble with whom Grote later exchanged views on cosmology. Grote graduated from the Armour Institute of Technology (now the Illinois Institute of Technology) with a degree in Electrical Engineering. He excelled in electronics courses but did less well in mathematics. After receiving his degree in 1933, Grote held a series of jobs with various Chicago companies including the Stewart-Warner and Belmont Radio Corporations.

Grote had a lifelong interest in electronics. At the age of 16, he received his amateur radio license, W9GFZ, signed by then Secretary of the Interior, Herbert Hoover. After contacting over 50 countries, he was looking for new challenges. He had read about Karl Jansky's discovery of cosmic radio emission and tried to interest astronomers at Yerkes Observatory, but except for Jesse Greenstein, they showed little interest. ''So,'' as he later related, ''I consulted with myself and decided to build a dish.'' He took astronomy courses from Philip Keenan and others at the University of Chicago. Using $2,000 of his own funds (about his annual salary), he took the summer of 1937 off from his engineering job at the Stewart-Warner Corporation to erect a 32-ft parabolic transit dish in a vacant lot next to his mother's house. Using his experience and skills as an electrical engineer and radio amateur he designed, built and tested a series of sensitive radio receivers, which he placed at the focal point of his parabolic dish. Following a succession of failures, in the spring of 1939, he finally succeeded in detecting the galactic radio noise and went on to make the first maps of radio emission from the galaxy and, in 1943, to detect radio emission from the sun.

Automobile ignition noise interfered with Reber's observations, so he observed only at night, laboriously writing down every minute the readings from his detector output. In the daytime, he returned to his job in Chicago, catching a few hours sleep each evening before returning to his observations; on weekends he analyzed his data. At first, Grote's discoveries were received with skepticism by the astronomical community and he had great difficulty in getting his papers accepted for publication in the astronomical literature. As he later claimed, ''The astronomers of the time didn't know anything about radio or electronics, and the radio engineers didn't know anything about astronomy. They thought the whole affair was at best a mistake, and at worst a hoax.'' But, following visits of Kennan and others to his Wheaton facility, he finally convinced *Astrophysical Journal* editor, Otto Struve, and others of the importance of his work. In addition to his classic publications in the *Astrophysical Journal*, *Nature*, and the *Proceedings of the Institute of Radio Engineers* (now the Institute of Electronic and Electrical Engineering), he also wrote influential reports in *Popular Science*, *Scientific American* and *Sky and Telescope*. In 1947, together with Jesse Greenstein, he wrote the first review of radio astronomy which was published in the journal, *Observatory*.



Grote Reber
Photo courtesy of Martin George

Plagued by local interference, he discussed with Otto Struve moving his antenna to a better site in Texas and also the possibility of building a much larger 200-ft dish. Reber recognized that an equatorial mount would be very expensive and proposed to use an alt-az mount together with an analogue coordinate converter of the type later implemented in Dwingeloo and Jodrell Bank. Through his younger brother Schuyler, then a business student at Harvard, he gained the interest of Harlow Shapley and Fred Whipple but he was unable to obtain any financial support from Harvard or any other university. Following his mother's death in 1945, Grote reluctantly accepted a position with the National Bureau of Standards in Washington and arranged to have his antenna re-erected in Washington where it was put on an alt-azimuth mount. But he was frustrated with government bureaucracy and disillusioned by the growing atmosphere of McCarthyism in Washington. In 1951, he moved to Hawaii where he pursued a variety of research programs in radio astronomy as well as atmospheric and ionospheric physics from the top of Haleakula on the island of Maui.

From Hawaii, he moved on to Tasmania in 1954, in order to exploit the ionospheric transparency associated with the south magnetic pole. While radio astronomers in the rest of the world were exploiting the newly emerging microwave technology to move to shorter and shorter wavelengths, Grote, characteristically departing from conventional ‘‘wisdom,’’ concentrated on the extremely long wavelengths. Working with Bill Ellis at the University of Tasmania, Reber designed and built a series of arrays to study Galactic radio emission and absorption at wavelengths of a few hundred meters. Following several years spent at the CSIRO Ionospheric Prediction Service, Grote moved from Hobart to Bothwell, in central Tasmania, where he designed and built an energy efficient home and where he lived for many years and made good friends.

With the growing importance after WWII of the contributions being made throughout the world by radio astronomy, Reber's pioneering studies ultimately became widely recognized. In 1961 he received the Cresson Prize from the Franklin Institute and in 1962, an honorary Doctor of Science degree from Ohio State University. He also received the AAS Russell Lecture Prize and the Bruce Medal of the Astronomical Society of the Pacific. Throughout his life, he had a strong interest in political and social issues. Writing to the Director of the NSF and the President of the NAS, he argued against big science and to reduce funding for large radio telescopes such as the VLA. Throughout his career, he questioned the ‘‘big-bang’’ universe and authored a widely distributed paper on ‘‘The Endless Boundless Universe.’’ He was greatly concerned about the consequences of world population growth and preserving our natural resources, particularly the overuse of fossil fuels, which motivated his research on electric cars and consideration of increased use of sailing ships. He had no tolerance for scientific or other activities that did not meet his high standards but he was generous in giving recognition and praise to those whose work he admired. A college era friend recently described Grote as ‘‘nervously energetic, enthusiastic, with a keen mind that went everywhere, an ever present, lively, sardonic, iconoclastic sense of humor, and strong opinions.’’

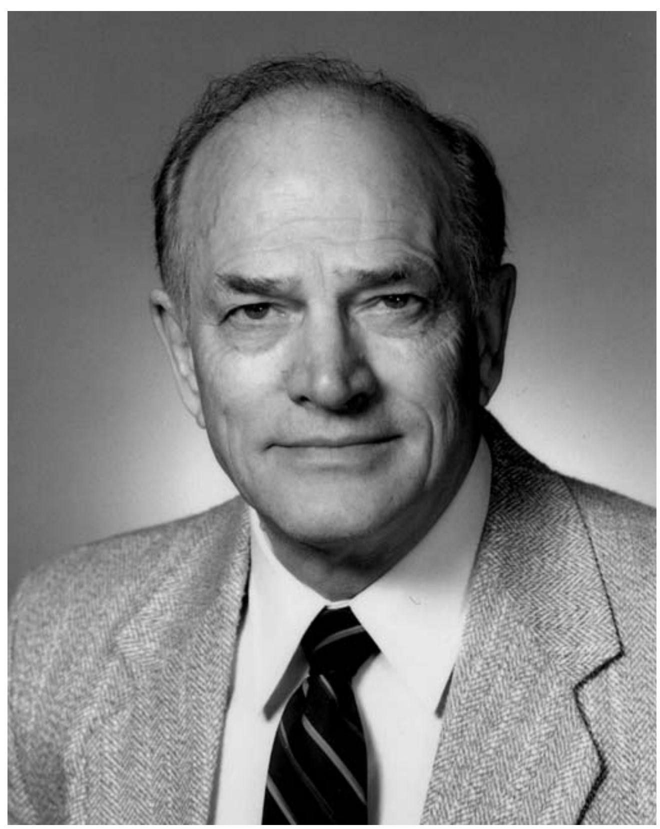
In addition to his pioneering work in radio astronomy, Reber also pursued and published research in a variety of fields ranging from radio circuitry and ionospheric physics to studies of cosmic rays, the atmosphere, archaeology and the growth of beans. He held a number of patents, including one for a radio sextant to ‘‘shoot the sun’’ on cloudy days. Throughout most of his career, he worked as an amateur relying on his deep curiosity along with his imagination and skills as an electronics engineer combined with his persistent, forceful personality, and stubborn disregard for conventional opinion. At various times, he held guest appointments at the National Radio Astronomy Observatory, Ohio State University, the Australian Commonwealth Scientific and Industrial Research Organization and, starting in 1951, he also received generous support from the Research Corporation in New York. However, he valued his independence and was skeptical of the strings that would be attached to any institutional support. He was scornful of establishment science, with its ‘‘self appointed pontiffs,’’ but his achievements were ultimately widely recognized by professional astronomers. Reber's extraordinary achievements as an amateur were probably unique in 20th century science.

Kenneth Kellermann
National Radio Astronomy Observatory

DOUGLAS H. SAMPSON, 1925–2002

Douglas H. Sampson, a renowned theoretical atomic physicist and a professor emeritus of astronomy and astrophysics at The Pennsylvania State University, passed away on 8 December 2002, in State College, Pennsylvania, of a hemorrhagic stroke. He had retired in 1997 after 32 years of service to the University and had maintained an active research program up to the day of his death.

Doug, as he was universally known to his friends and colleagues, was born in Devils Lake, North Dakota on 19 May 1925. His parents, Abner and Mabel Sampson, were farmers. He was raised without running water or electricity on a farm, homesteaded by his ancestors in Edmore, North Dakota. He was one of two children in his class at a two-room rural elementary school and graduated as valedictorian from Edmore High School in 1944. No physics classes or advanced mathematics classes were offered in his small high school. In 1956, he was married to Carlyn Grutzner.



Douglas H. Sampson

During Doug Sampson's military service in the United States Army from February 1945 until December 1946, he was selected as a MP (Military Policeman) in the Philippines. His military experience provided him with the opportunity to attend college under the GI Bill. Because he had to work on the family farm, he started college a month later every fall and took exams a month earlier each spring. Nevertheless, Sampson graduated as co-salutatorian from Concordia College, Moorhead, Minnesota in 1951 with a BA degree with majors in physics and mathematics. Afterwards he received his MS and PhD degrees in theoretical physics from Yale University in 1953 and 1956 under the guidance of Henry Margenau. Sampson then became a staff member of the Theoretical Division of the Los Alamos National Laboratory until 1961. While there he performed calculations of fundamental atomic cross sections used in the determination of opacities for radiation transport simulations. The calculation of high quality atomic data would end up being a life long pursuit.

During this period he was also a visiting staff member in the Theoretical Division, National Aeronautics and Space Administration. During the interval 1961–1964, he worked at the Valley Forge Space Center of the General Electric Company, where he became leader of the atomic and radiation physics group. While working there, he took advanced courses in relativistic quantum mechanics and field theory at the University of Pennsylvania. He joined the faculty of Penn State in 1965 as an associate professor in the recently created department of astronomy and became a full professor in 1969. During his career at Penn State, he contributed a substantial share toward the unprecedented growth in the intellectual stature of the department.

Doug's research at Penn State focused on developing theory and corresponding computer programs for calculating cross sections or rates for various atomic processes in very high-temperature gases, or plasmas, which commonly occur in astrophysics, fusion-energy research, and X-ray lasers. The atomic data for these processes help scientists understand high-temperature plasmas and predict the spectra that emerge from them. His early work primarily involved electron-impact processes for nonrelativistic ions. A goal of this research was to perform large-scale, computer-intensive calculations of the fundamental cross sections, and then fit these results to various functional forms so the data could be obtained quickly and accurately by plasma modelers. Doug had noted that for a hydrogenic ion, the relevant matrix elements used in the calculation of cross sections for excitation, scale with the nuclear charge. He realized that it would be possible to obtain quite accurate cross sections for more complex ions by scaling the hydrogenic results by an effective charge. Furthermore, he worked out angular algebra coupling for complex ions with many bound electrons and included the effects of configuration and intermediate coupling mixing in the target states. In this way, he was able to generate cross sections for isoelectronic sequences with affordable computational time. He applied this method to both electron-impact excitation and ionization. This important work took place when computational power was a small fraction of current standards and it allowed relatively massive amounts of cross section data to be calculated for a variety of ions with application to astrophysics and fusion research.

By 1985 Doug turned his attention to treating the electron-ion collision problem in a fully relativistic manner, in support of X-ray laser research. He and his research group developed an approach and associated computer programs, including an atomic structure program and electron-impact excitation and ionization programs that were based on solving the Dirac equation. His efforts were also devoted to making the computer codes very efficient so they could rapidly produce large amounts of data. At this time supercomputers were becoming more accessible, which provided much-needed computer power for a fully relativistic treatment of heavier elements. However, a brute force approach was still not feasible and Doug was able to apply a number of numerical procedures that greatly reduced the required computing time while preserving the accuracy of the calculations. This sustained effort (spanning about 17 years) resulted in a suite of robust codes that can be used to determine fundamental atomic cross sections or rates for a wide variety of plasma modeling applications. In addition, Sampson applied the fitting procedures to vast quantities of these relativistic data, making them readily available to a broad audience of researchers.

Both of these non-relativistic and fully relativistic approaches, along with the associated computer codes, are currently in use at the Los Alamos National Laboratory, Lawrence Livermore National Laboratory and the Naval Research Laboratory to model the high-temperature plasmas produced there. Although his major efforts were directed toward the rapid production of large amounts of atomic data, Doug had always been a serious researcher, verifying the calculations against experimental data whenever possible.

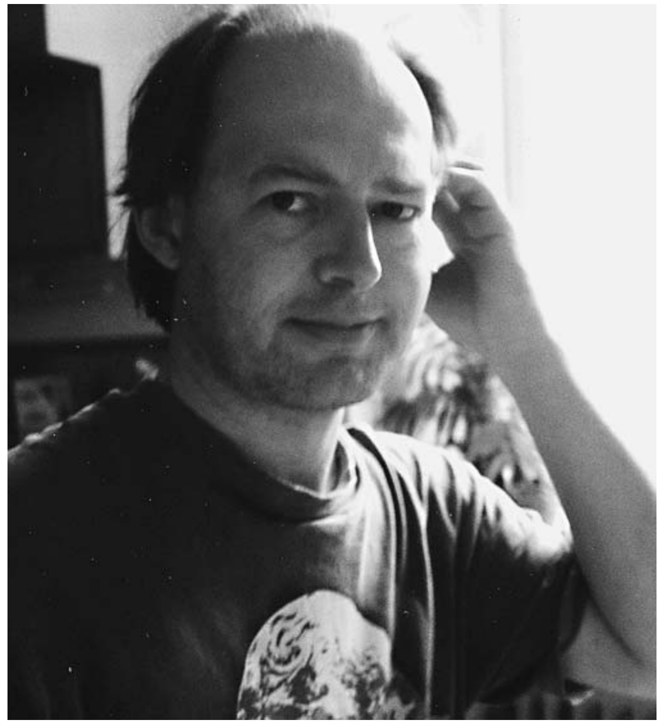
In the course of his work Doug guided a number of PhD students through the Astronomy and Astrophysics Department and the Physics Department. He was always available for discussions of all aspects of the work and willing to listen to his students. A lasting legacy of his work was the care he took in ensuring the accuracy of each step, down to careful reading of the gallery proofs from the journals. He emphasized that even if one had the best theory, but made an error in computer coding, or in producing a table, the resulting incorrect data were of no value. This emphasis on accuracy and faithful reproduction of the theory in the application to a plasma modeling calculation has served his students well. At least three of these students went on to work on data applications at Los Alamos National Laboratory, continuing the tradition of careful application of atomic theory to plasma modeling.

Doug was an active graduate and undergraduate teacher, developing a number of upper-level courses in astrophysics, and serving as chairman or member of many departmental and university committees. Undergraduate students invariably commented on his accessibility, patience and human warmth. Sampson presented papers and seminars at numerous conferences and institutions in the United States and abroad, and authored or coauthored over 110 research papers in refereed journals. He was also the author of a book, *Ra-*

diative Contributions to Energy and Momentum Transport in a Gas, published by Wiley-Interscience. He consulted with Gulf General Atomic Incorporated; Systems, Science, and Software; the Los Alamos National Laboratory; and the Lawrence Livermore National Laboratory. He was a Fellow of the American Physical Society, and a member of the American Astronomical Society and the International Astronomical Union. He spent his last sabbatical leave before his retirement at The Mathematical Institute, University of Oxford. At the time of his death he was working on a manuscript for Physics Reports, summarizing his research in relativistic atomic theory.

Doug had an unobtrusive but keen sense of humor, as well as a positive outlook on life, and remained physically active throughout his life. His colleagues will remember him for his willingness to listen and to help, as well as for his strong sense of pioneer values and humanity. His hobbies included the study of American history and the history of Western Civilization. He is survived by his wife Carlyn, their four children and ten grandchildren.

Peter Meszaros
Pennsylvania State University
Robert E.H. Clark
International Atomic Energy Agency,
Vienna Honglin Zhang and Christopher J. Fontes
Los Alamos National Laboratory



Roland Svensson
Photo courtesy of C.-I. Björnsson

ROLAND SVENSSON, 1950–2003

Roland Svensson was found dead on 8 April 2003. He succumbed to the complications arising from diabetes. His contribution to the understanding of the basic properties of relativistic plasmas remains a cornerstone when studying radiation processes in many astrophysical contexts.

Roland was born on 6 May 1950 in Karlshamn, Sweden. At a young age he moved with his family to Skåne, the southernmost part of Sweden. This is where he received his early education including a BS in Physics at the University of Lund in 1973. For the rest of his life, this region was home for Roland. His mother and father are Linnea Martinsson (d. 1984) and Sune Svensson. The two younger brothers are Lennart and Peter. Lennart works as a machine engineer in Sweden while Peter has settled in California as a biology professor.

Roland started graduate studies in theoretical physics in Lund before receiving a Fulbright Scholarship in 1976. He then moved to the University of California in Santa Cruz and enrolled in the astronomy and astrophysics graduate program. Although his interest in astronomy had been raised during the time in Lund, it was the stimulating environment in Santa Cruz that convinced Roland to concentrate on research in astronomy. With Roland's attitude of never accepting anything unless he understood its roots, his extended background in physics served him well throughout his astronomy career; in particular, it influenced his choice of a thesis topic. At the time, the importance of relativistic temperatures attained by accreting matter in the immediate vicinity of neutron stars and black holes was becoming clear. Roland set out to make a detailed description of the physical effects electron-positron pair production and annihilation would have on such plasmas. In 1981 Roland defended his thesis titled ''Physical Properties in Relativistic Plasmas'' and completed his PhD under the supervision of Bill Mathews. Roland extended the results of his thesis during two post-docs, first at the European Southern Observatory (ESO) in Munich and later at Nordita in Copenhagen. He stayed another five years at Nordita as assistant professor. In 1990 he moved to Stockholm Observatory to take up the chair in astrophysics and cosmology.

Roland's fundamental work on pair-plasmas was done alone. It was during his time at Nordita that this aspect of Roland's research started to change. He now took the first steps towards establishing an international network within high-energy astrophysics, a pursuit that was to intensify during his time at Stockholm Observatory. The initial impetus for this was Roland's desire to develop the applications of his early work to concrete astrophysical phenomena. An important part of this effort was to engage other scientists that could complement his own background. His initiative and coordination were behind many subsequent research projects. Starting with quasars and active galactic nuclei, his interest widened to include compact X-ray binaries and gamma-ray bursts. Roland's interest in observational astronomy and data analysis grew with time. As a result his group in high-energy astrophysics at Stockholm Observatory initiated Swedish participation in several international space-based observatories, including INTEGRAL and GLAST. One of the aims of his network was to involve scientists from Russia and the eastern European countries. Due to Roland's diligence in writing applications, this led to a lively scientific exchange, which proved to be an important factor in the success of the network. It also helped these countries to further their international contacts in general.

Roland enjoyed teaching and it was a source of inspiration for him. Well-prepared lectures in combination with his sensitivity and ability to listen made him a teacher much liked by the students. He was at his best with a small group where teaching could develop into discussion. With his patience and desire to convey the essence of an argument, he could go a long way to help a student but, at the same time, he made it clear that the responsibility for learning lay with the student. He was, for a long time, director of graduate studies at Stockholm Observatory. The present graduate program owes much to Roland's efforts to modernize its structure and bring it up to an international level.

Throughout his life, two of Roland's guidelines were respect for others and responsibility for ones own doing. Although Roland was a private person who valued his integrity, he had a great interest in people. He was an often seen guest at dinners and other social events, where his wry humor together with an outstanding memory and affection for details spurred many a discussion and caused much laughter. At such occasions Roland also excelled as a photographer; in particular, he had an eye for catching the mood and character of the people around him. With his strong personality and firm belief in science as a guiding star, Roland leaves behind a memory of one who chose a way through life that was truly his own.

Claes-Ingvar Björnsson
Stockholm Observatory

ANNE BARBARA UNDERHILL, 1920–2003

Anne Barbara Underhill
Photo courtesy of H. Lamers

Anne was born in Vancouver, British Columbia on 12 June 1920. Her parents were Frederic Clare Underhill, a civil engineer and Irene Anna (née Creery) Underhill. She had a twin brother and three younger brothers. As a young girl she was active in Girl Guides and graduated from high school winning the Lieutenant Governor's medal as one of the top students in the Province. She also excelled in high school[19] sports. Her mother died when Anne was 18 and, while undertaking her university studies, Anne assisted in raising her younger brothers. Her twin brother was killed in Italy during World War II (1944), a loss that Anne felt deeply.

Possibly because of fighting to get ahead in astronomy, a field overwhelming male when she started, she frequently appeared combative. At the University of British Columbia, Anne obtained a BA (honors) in Chemistry (1942), followed by a MA in 1944. After working for the NRC in Montreal for a year, she studied at the University of Toronto prior to entering the University of Chicago in 1946 to obtain her PhD. Her thesis was the first model computed for a multi-layered stellar atmosphere (1948). During this time she worked with Otto Struve, developing a lifetime interest in hot stars and the analysis of their high dispersion spectra. She received two fellowships from the University Women of Canada.

She received a U.S. National Research Fellowship to work at the Copenhagen Observatory, and upon its completion, she returned to British Columbia to work at the Dominion Astrophysical Observatory as a research scientist from 1949–1962. During this period she spent a year at Harvard University as a visiting professor and at Princeton where she used their advanced computer to write the first code for modeling stellar atmospheres. Anne was invited to the University of Utrecht (Netherlands) as a full professor in 1962. She was an excellent teacher, well liked by the students in her classes, and by the many individuals that she guided throughout her career. She tried conscientiously to learn Dutch with only moderate success. She started her lectures in Dutch but switched to English when she was excited. For a semester, she talked of black body radiation; the Dutch came out as "black corpse radiation." The students enjoyed this so much that they never corrected her. While in Utrecht, she served briefly on the editorial board of the Astrophysical Journal.

After Utrecht, Anne returned to North America to work with NASA's Goddard Space Flight Center in Greenbelt Maryland. The senior scientists at Goddard were looking for a competent astronomer who could help raise the scientific standards of the laboratory. Anne was successful in this aim, particularly in guiding and encouraging the younger staff. As project scientist for the International Ultraviolet Explorer, she contributed greatly to the success of that project. In 1969, Anne received an honorary degree from York University.

The period as Goddard Lab Chief was trying for Anne and she was happy to accept a Senior Scientist position. She spent two years in Paris collaborating with Richard Thomas editing a series of books on astronomy. Of these, she wrote *O-Stars and Wolf Rayet Stars* in collaboration with Peter Conti, and *B Stars With and Without Emission Lines* in collaboration with Vera Doazan. Both books were well received. On return from Paris she continued scientific research until she retired in 1985.

Upon retirement, Anne returned to Vancouver and became an honorary professor at the University of British Columbia. She had an office, library facilities and the stimulation of colleagues. She enjoyed helping and mentoring the women students and she was happy to get back to observing at the Dominion Astrophysical Observatory in Victoria. In 1985 she received the D.S. Beals award, given to a Canadian astronomer for outstanding achievement in research. She was also elected a Fellow of the Royal Society of Canada in 1985. She received a D.Sc. from the University of British Columbia in 1992.

Anne was one of the world experts on hot stars who influenced many students as well as the entire field. Between 1945 and 1996 she published more than 200 papers in refereed journals or symposium proceedings in addition to books. Her legacy will be long lasting.

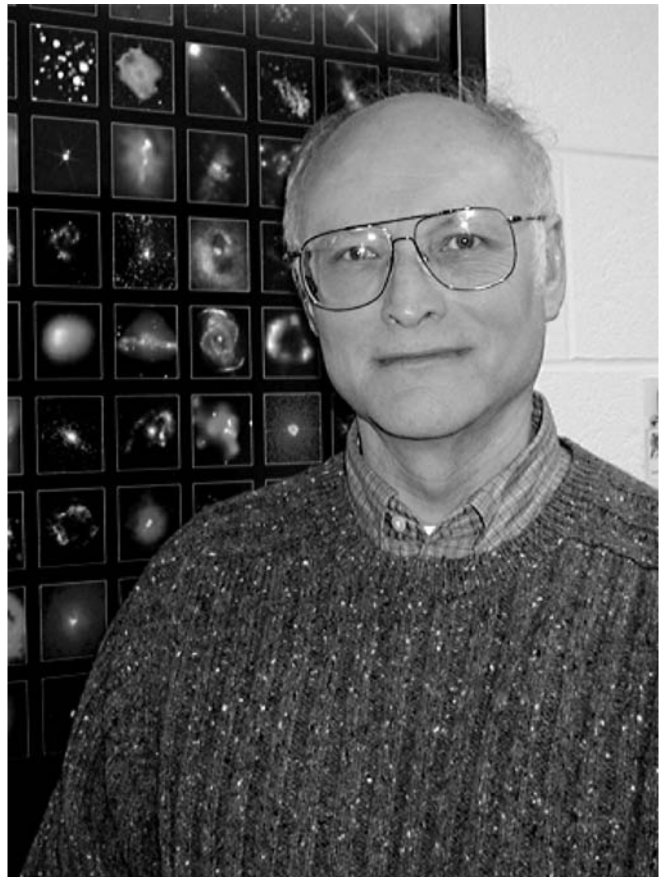
The following quote from Giusa-Cayrel de Strobel, an acquaintance of 50 years, summarizes the impression she left. ''In writing this brief note, many meetings we attended together are coming in my memory. They evolved almost always in the same way: first, our joy of the encounter, then the appearing of a scientific disagreement between us, and afterwards, before parting, the reconciliation. Anne never held an argument against her opponent; some of the people she admired and liked most were those with whom she argued vehemently.''

Anne cared passionately about astronomy and defended her views vigorously both individually and at meetings. She had difficulty making friends but those who got beyond the surface found that she was a kind, generous, and caring person as well as good company.

Anne was deeply committed to her religious faith and sang in choirs as long as she could. She loved hiking, traveling the world, and music. In 2002, her health began deteriorating and was further weakened by several small strokes. Anne died on 3 July 2003 at the age of 83. She is remembered fondly by her family, friends, and former colleagues.

Nancy Grace Roman

LEON VAN SPEYBROECK, 1935–2002



Leon Van Speybroeck
Photo courtesy of K. Kowal

Leon Van Speybroeck, a master designer of X-ray telescope mirrors and the telescope scientist for the Chandra X-ray Observatory, died in Newton, Massachusetts, on 25 December 2002, shortly after learning that he had metastatic melanoma. Leon was born on 27 August 1935 in Wichita, Kansas. His father, Paul, was Assistant Treasurer and head of the accounting department at Beech Aircraft, and his mother, Anna Florence (Utley), was a homemaker. Both parents died in 1996. Leon's younger sister, Saundra, is a nurse and his younger brother, John, is a surgeon.

Leon received a BS in 1957 and a PhD in 1965, both in physics, from MIT. His PhD thesis, ''Elastic Electron-Deuteron Scattering at High Momentum Transfer,'' was carried out under the supervision of Henry Kendall and Jerome Friedman. Leon spent two more years at MIT as a research associate.

In 1967, he was hired by American Science and Engineering (AS&E) in Cambridge, Massachusetts, and joined the X-ray astronomy group led by Riccardo Giacconi, who received the 2002 Nobel Prize in Physics for contributions to astrophysics that led to the discovery of cosmic X-ray sources. Leon soon became involved in the design and construction of high-resolution, grazing-incidence X-ray telescopes, starting with the Apollo Telescope Mount flown on NASA's Skylab from 1973 to 1974. A series of high-resolution X-ray images of the solar corona led to dramatic changes in ideas about the solar corona, with new emphasis on magnetic dynamo processes.

When the Smithsonian Astrophysical Observatory and the Harvard College Observatory morphed into the Harvard-Smithsonian Center for Astrophysics (CfA) in 1973, Leon, with Giacconi and other senior X-ray astronomers from AS&E, joined the CfA and formed the high-energy astrophysics division. Leon guided the design and development of the X-ray mirrors on NASA's Einstein Observatory, which was flown from 1978 to 1981 as the first cosmic X-ray observatory with an imaging telescope. Along the way, he helped the team to solve numerous technical challenges—for example, floating the heavy optics in a mercury bath so that their roundness could be measured without gravitational distortion. The Einstein data, which showed that virtually all classes of astronomical sources are X-ray emitters, opened the door for X-ray astronomy to join the other wavelength domains as an equally important discipline. In recognition of his accomplishments, Leon received the George W. Goddard Award in 1985 from the International Society for Optical Engineering.

While the Einstein Observatory was still operating, work began on a successor with a larger effective area and substantially higher angular resolution. Leon led the technology development and then the flight program for the optics on this Advanced X-ray Astrophysics Facility (AXAF). He insisted on systematic analyses and thorough understanding of all the processing steps and metrology data. He negotiated the establishment of incentives and goals for mirror smoothness, and achieved an increase in the fraction of 6-keV X-rays encircled in a 1-arcsecond diameter from 20% to 60%. With his guidance and the efforts of many superb engineers and scientists, polishing and metrology equipment was designed, built, tested, and used at Hughes Danbury Optical Systems Inc., located in Danbury, Connecticut. The equipment was utilized to fabricate X-ray mirrors at the 0.5-arcsecond level of performance−10 times better than any previous X-ray optic.

Following the successful fabrication of the optics, Leon worked with the team at Optical Coating Laboratory Inc, in Santa Rosa, California, to establish a process for depositing iridium coatings that provide a relatively high efficiency up to 10 keV and a very stable final surface. The AXAF telescope comprises four pairs of mirrors nested one inside another to increase the collecting area. A major challenge involved assembling the eight cylindrical optics into a single high-resolution telescope. Leon and the team at Eastman Kodak Company in Rochester, New York, designed a 50-foot-high vertical assembly tower that satisfied demanding environmental controls. The mirror elements were held as stress free as possible, maneuvered into alignment, and bonded into place with a slow-curing epoxy to a precision of a few tenths of an arcsecond. Following its launch aboard the space shuttle Columbia in July 1999, AXAF was renamed the Chandra X-ray Observatory. Up to the time of his death, Leon had been leading a team that used Chandra, plus microwave observations of galaxy clusters, to determine the cosmic distance scale. His colleagues expect to publish their results in late 2003. In recognition of his leadership and extraordinary contributions to Chandra, Leon received the 2002 Bruno Rossi Prize of the American Astronomical Society's high-energy astrophysics division. He died two weeks before he was scheduled to deliver his acceptance speech. Despite his illness, he had crafted a marvelous talk illustrating the tremendous advances enabled by the Chandra telescope. One of us (Tananbaum) presented his talk, which received an enthusiastic response from approximately 1000 AAS members.

Leon married Erin Harrington in 1959. She survives him along with their daughter Elaine and her husband Lane Kendig; son David, his wife Jennifer Hanson, and their twin daughters Madeline and Nina; and son Alexander and his companion Sherie Davis. When not involved with X-ray telescopes or family trips to National Parks, Leon designed and built exquisite furniture in his elaborate workshop, where every tool hung neatly from its pegboard hook. On 8 February 2003 more than 200 friends and family members gathered at the Harvard Science Center for a Remembrance Service. Many smiles and more than a few tears were seen as people recalled and celebrated Leon's life.

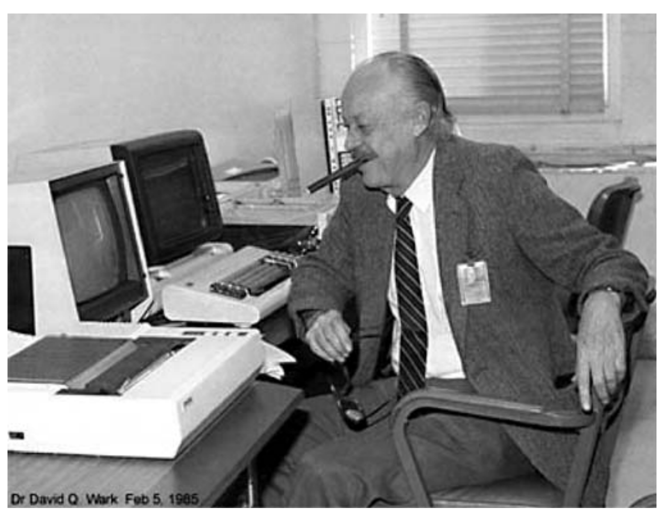
Leon was an amazing individual, respected by his colleagues as an outstanding physicist, mathematician, programmer, and engineer who could solve just about any problem. He set and met incredibly high standards in his professional and personal endeavors. He was modest about his accomplishments, but would acknowledge that ''Chandra has a pretty good mirror'' when colleagues would share exciting new results made possible by his dedicated efforts and unique skills. It was a privilege to know him.

Paul Gorenstein
Harvey Tananbaum
Harvard-Smithsonian Center for Astrophysics

DAVID Q. WARK, 1918–2002

David Q. Wark, a research meteorologist at the National Environmental Satellite, Data, and Information Service of the National Oceanic and Atmospheric Administration (NOAA/NESDIS) and its predecessor organizations for 55 years, died of cancer 30 July 2002. He will be long remembered for his seminal contributions to the weather satellite program.

A pioneer in the use of satellite sensors to provide observations of the Earth's environment for application to weather forecasting and atmospheric science, Dr. Wark was noted for his brilliant insights, dedication, and exceptional scientific achievements. He developed many of the theoretical and experimental techniques on which NOAA's current multi-billion-dollar meteorological satellite program is based. In the 1960's and early 1970's, he and his NOAA colleague Donald Hilleary were the motivating force and principal investigators for the first satellite instruments dedicated to sounding the atmosphere for temperature and water-vapor. These instruments included the Satellite Infra-Red Spectrom-



David Q. Wark
Photo courtesy of NOAA

eter (SIRS)-A and -B and the Vertical Temperature Profile Radiometer (VTPR), which were flown on NASA's Nimbus satellites and NOAA's ITOS-D satellites, respectively. With colleague Henry Fleming, he formulated the radiative transfer equation that quantifies the spectral radiances of the Earth and its atmosphere (measured at satellite altitude) and inverted that equation mathematically to infer the atmospheric temperature profile from satellite-based measurements of those radiances. A difficulty they had to overcome was that the mathematical problem is ill-posed, i.e., it admits of an infinite number of solutions. They arrived at a unique solution via an innovative application of a-priori information on the atmospheric state. This work was described in the landmark 1965 Wark and Fleming paper in the American Meteorological Society's Monthly Weather Review. From that early period until just weeks before his death, Dr. Wark continued his work at the Office of Research and Applications in NOAA/NESDIS on developing advanced techniques for sounding the atmosphere from satellites.

Dr. Wark's work in remote sensing of the Earth's atmosphere and surface from weather satellites benefited from his skill both as a meteorologist and an astronomer. Most of his work was directed toward the goal of deducing vertical temperature and moisture profiles in the Earth's atmosphere, but he also proposed a method for obtaining cloud top altitudes using the oxygen A band. In the early days of this effort at NOAA/NESDIS and its predecessor agencies, Dr. Wark and others (most notably Dr. S. Fritz), assembled a remarkable group of internationally known scientists at NOAA to work on this pioneering effort and made Suitland, Maryland an exciting place to work. Included in this group of visiting scientists were G. Yamamoto, D. G. James, S. Twomey, and F. Saiedy. In addition to his own insights, Dr. Wark proved to have a remarkable facility for subdividing the complex temperature profiling problem into smaller component problems that the visiting and U.S. scientists could attack without interfering with each other. Despite his well-deserved reputation for having a formidable personality, he guided the development of the satellite temperature profiling field with tact, diplomacy, and scientific acumen. During this time, Dr. Wark also brought to NESDIS, and guided, a number of younger scientists who went on to establish reputations of their own in the fields of satellite remote sensing and satellite meteorology. These included J. Alishouse, L. Crone, D. Crosby, H. Fleming, H. Jacobowitz, L. McMillin, W. L. Smith, L. Stowe, and M. Weinreb.

A Fellow of the American Meteorological Society, Dr. Wark received numerous awards from various scientific organizations, including a Silver Medal and a Gold Medal from the U.S. Department of Commerce, the Medal for Exceptional Scientific Achievement from NASA, the 2nd Half-Century Award from the American Meteorological Society, the Lloyd V. Berkner Space Utilization Award from the American Astronautical Society, and the Robert M. Losey Award, from the American Institute of Aeronautics and Astronautics.

David Quentin Wark was born on 25 March 1918, in Spokane, Washington. He was the fourth and last child of Percival Damon Wark and Clara Belle (née Mackey) Wark. In 1921 his family moved to Altadena and Pasadena, California, where he lived until 1939. He attended Altadena Elementary School, Edison Elementary School, Washington Junior High School, Pasadena High School, and Pasadena Junior College. From 1938 to 1939, and again in the summer of 1940, he worked for the Associated Press and David Lawrence to earn money to resume his education. In 1939, he entered the University of California, Berkeley, from which he graduated with a BA in Astronomy with honors in May 1941.

From 1941 to 1942 he did graduate study in meteorology at the University of California, Los Angeles. He resumed graduate studies part time in 1948 at the University of California, Berkeley, while working full time at the U.S. Weather Bureau and graduated with a PhD in Astronomy in January 1959. He remembered those times as tough days driving back and forth to Berkeley and living in Half-Moon Bay.

Dr. Wark's professional career began in 1942 at the U.S. Naval Observatory, where he served as a Naval Officer until 1946. He then went to work for the U.S. Weather Bureau. He spent the first three years of that period in Istres, France, Frankfurt and Munich, Germany, and Cairo Egypt. From 1949 through 1958 he served at the Aviation Weather Forecast Office in San Francisco. He then moved to the U.S. Weather Bureau Office in Suitland, Maryland, where he worked from November 1958 until 3 July 1999, when he officially retired. He actually retired from NOAA because during this time, he saw the U.S. Weather Bureau become part of ESSA which, in turn, became a part the National Oceanic and Atmospheric Administration (NOAA) in 1970. But retirement did not stop his work or his contributions to science. In his last 3 years, Dr. Wark took a part-time post-retirement position at NOAA/NESDIS where he continued to work in the field he pioneered and to which he dedicated his life.

One could not talk to Dr. Wark for long without learning of his keen interest in sailing. He was especially proud of his 4-year adventure in which took periodic time from work to sail around the world (from 1982–1986) on his 38′ cutter the Capella. During this time he (and a crew of 2) spent almost an entire year on the open seas, beginning the trip at Solomons, Maryland, and including stops in Ft. Lauderdale, Cancun, Panama, Galapagos Islands, French Polynesia, Cooke Islands, Niue, Tonga, Fiji, Vanuatu, Australia, Christmas Islands, Mauritius, Reunion, South Africa, St Helena, Brazil, the Virgin Islands and back home again along the North Carolina coast. His meteorological interest showed in the detailed series of bucket temperatures he took on this trip. On his return he obtained the corresponding satellite measurements and made comparisons between his temperatures and the surface temperatures measured by the satellite. He often made comments about how rare a cloud-free sky was, at least in the vicinity of oceans. A few years later he circumnavigated the eastern half of the United States via rivers, inter-coastal waterways, and canals, a trip of approximately 2000 miles. This voyage ended in 1990, when he was 72 years of age. Some of the segments of this voyage he sailed single-handedly, a remarkable achievement.

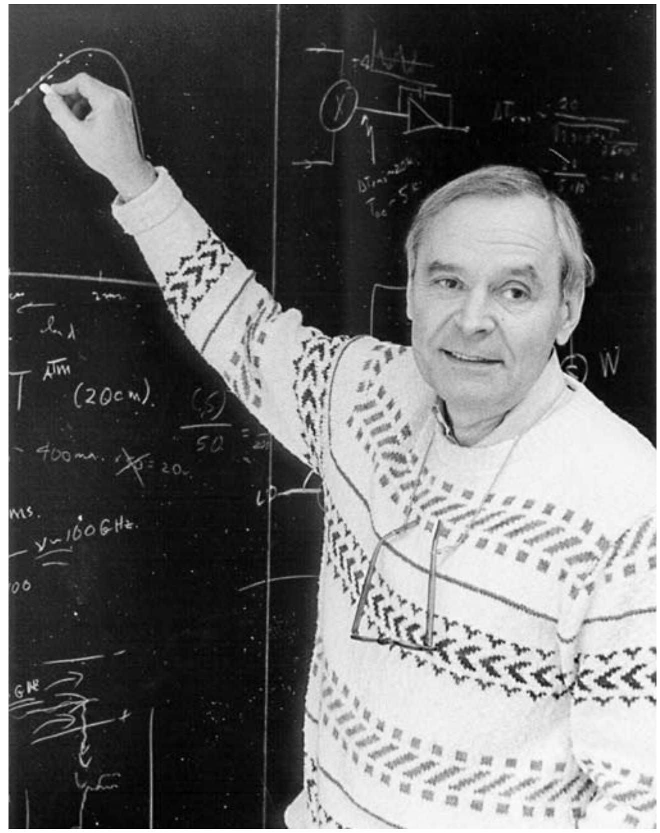
This biography would not be complete without mentioning the famous cigars. Dr. Wark acquired a reputation among his colleagues for hardly ever being seen without a well-chewed cigar, damp on one end, lit on the other, in his hand. When computers were in their infancy, discs were not as well sealed as they are today, and the one in Dr. Wark's office seemed to experience an inordinate frequency of failures. Finally, in exasperation, he decided to investigate. On pulling the disc out and examining it with a microscope, he observed a speck of cigar ash that had landed on the disc's surface and scratched it. From that time on, although he was seldom seen without a tattered cigar, it was never lit when he was in his office.

Dr. Wark was dedicated to his parents and the field of meteorology. This dedication was demonstrated when he provided a generous donation to the AMS to establish the Percival D. Wark and Clara B. (Mackey) Wark Scholarship. This is an annual scholarship to be awarded to a student majoring in atmospheric or related oceanic and hydrologic sciences.

Dr. Wark is survived by his nephew Walter Damon Wark of no fixed address, and his great nephew Christopher Hal Wark of Fresno, California. His two brothers, Francis Walter and Robert Damon, as well as his sister, Dorothy Marie (née Wark) Schaertl, pre-deceased him.

Larry McMillin
NOAA

DAVID TODD WILKINSON, 1935–2002



David Todd Wilkinson
Photo Courtesy of Robert Matthews

David Todd Wilkinson died on 5 September 2002. He had battled cancer for seventeen years. His role in the measurements of the thermal cosmic background radiation (the CMB) was key to the completion of the program of cosmological tests that began around the time of his birth in the 1930s.

Dave was born on 13 May 1935 in Hillsdale, Michigan, and was raised and received his early education there. His mother and father are Thelma Todd (d. 1994) and Harold Wilkinson (d. 1994). From his father, a self-employed electronics specialist, Dave developed a strong interest in how things work. His mother was an elementary school math teacher and she maintained high academic standards for her sons. An older brother, Ramon (d. 1999) was an aeronautical engineer. As a student at the University of Michigan, Dave played saxophone in a jazz band. He earned a BS in Engineering in 1957, and an MS in Engineering in 1959. Since a course on steam tables had turned his interest to physics, he stayed at Michigan for further graduate work with Richard Crane. In 1962 Dave defended his thesis, a test of the quantum theory of electromagnetism titled *A Precision Measurement of the g-Factor of the Free Electron*, and completed his PhD in Physics. He remained at Michigan for another year as an instructor.

Dave joined Bob Dicke's research group at Princeton University in 1963. His first project at Princeton, with Dicke, was the design of optical retro reflectors that the Apollo astronauts placed on the moon. Laser ranging with the retro reflectors is still providing measurements of the distance of the moon for precision tests of gravity physics. With Peter Roll and Jim Peebles, Dave then set out to search for the faint cosmic microwave background (CMB) radiation that would fill the universe in a hot Big Bang cosmology. At the same time Robert Wilson and Arno Penzias at Bell Laboratories were seeking diffuse emission from the outer parts of our galaxy. Their search required a helium cold load that made their experiment sensitive to the CMB. News of the Princeton experiment led them to believe that they had found the thermal radiation Wilkinson and Roll were seeking. The Princeton and Bell Labs results, at different wavelengths, gave the first evidence that the CMB spectrum agrees with the hot Big Bang.

Realizing that accurate measurements of the CMB would be an invaluable probe of the large-scale structure and evolution of the universe, Dave led pioneering studies of experimental cosmology from 1965 to the time of his death. These experiments were aimed at checking whether the CMB spectrum really is close to thermal, as required of a remnant of the hot Big Bang, and whether there are tiny variations in the radiation temperature across the sky, as would be produced by the gravitational growth of the present clustering of matter in an expanding universe. His experiments include the first CMB balloon flights, the first dedicated CMB polarimeter, and the first dedicated CMB interferometer. He established the learning curves for these difficult measurements, and found the best places to do them: Princeton rooftops, deserts, mountains, balloons, and space. The results have driven the development of the standard model for cosmic structure formation and the new generation of cosmological tests. In the process Dave trained a large fraction of the scientists now engaged in this wonderfully productive field of experimental cosmology.

Dave had an important influence on the origin of the COBE (Cosmic Background Explorer) satellite. COBE demonstrated that the spectrum of the CMB is very close to thermal, compelling evidence that the universe expanded from a denser hotter state because space now is transparent and is incapable of thermalizing the radiation. The WMAP (Wilkinson Microwave Anisotropy Probe) satellite now in orbit is making accurate measurements of the angular distribution of the CMB temperature. WMAP's design follows Dave's philosophy: keep it simple, but build in abundant checks for systematic errors. He was delighted with the results; the community is witnessing yet another great advance in precision tests of the relativistic cosmological model. The satellite was renamed this past February to honor Dave.

Dave had many other scientific interests. With Princeton students and colleagues he studied precision optical pulsar timing in our galaxy and placed bounds on pulsars in nearby galaxies; pioneered the use of CCD detectors for cosmology; introduced the search for the young galaxies at high redshift that now are teaching us so much about how galaxies formed; and developed methods for the measurement of the energy density in starlight integrated back to the edge of the observable universe, a critical datum for cosmology. Most recently, a freshman seminar on extraterrestrial life led him to team up with a Harvard project to detect fast optical pulses that an advanced civilization might send our way. Dave organized a volunteer group to revitalize Princeton's Fitz Randolph Observatory and recruited amateur astronomers to run the project.

Dave was passionate about teaching. He gave demonstrations of giant bubbles at elementary schools. He lectured to Princeton alumni groups and to state and federal judges. He was a member of working groups on undergraduate education at the National Academy of Sciences and the American Physical Society. He helped develop an intensive sophomore course in experimental physics and a three-semester introductory physics course that brought students who might have been turned off by the pace of the standard introductory physics course into science and technology. And when Dave taught the standard course, his ratings by his students were among the highest at the University. For all that, however, Dave preferred to teach graduate students in the laboratory; they learned from him to be mentors as well as physicists.

Elected to the National Academy of Science in 1983, Dave was further honored by the award of the NAS James Craig Watson Medal in 2001. He was a fellow of the American Academy of Arts and Sciences and the American Physical Society. The University of Chicago conferred an honorary PhD on Dave in 1996.

In 1984, Dave married Eunice Dowell, who survives him along with his two children, Wendy and Kenton, and three stepchildren, Marla, Michael and Janice Dowell. His family remembers him most recently for his devotion to his five grandchildren, for his love of fishing, hiking and family vacations and as an ardent fan of the New York Yankees.

Dave's science often took the path less traveled, with results that have seeded large and active fields. He showed by example that the experimenter's conscience can be the best defense against bad science. Dave embodied so much of what we aspire to as scientists and as people. His effortless charm and natural affinity for people, his generosity with time, and his total absence of self-promotion, brought out the best in all who were privileged to know him.

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