# Obituaries

## Prepared by the Historical Astronomy Division

### ARTHUR EDWIN COVINGTON, 1913–2001

Arthur Edwin Covington, Canada's first radio astronomer and founder of the daily 10.7-cm solar flux patrol, died peacefully in his home in Kingston, Ontario after a lengthy illness on 17 March 2001. He was eighty-eight years old. His wife Charlotte and their four children, Nancy, Eric, Alan, and Janet survive him. Covington was born in Regina and educated in Vancouver. Deeply absorbed with radio science and astronomy from his youth, Covington graduated in mathematics and physics from the University of British Columbia (UBC) in 1938. He stayed at UBC to complete a Master's thesis on lens design for electron microscopes. But in 1940 he moved to the University of California, Berkeley, to begin graduate studies in nuclear physics. He met and married fellow physics student Charlotte Anne Riche in Berkeley. In 1942, the Covingtons moved to Ottawa to join Canada's wartime research effort in radar at the Radio Branch of the National Research Council's Laboratories (NRCL).

Well aware of Jansky's and Reber's discoveries of ''cosmic radio noise'' at metric wavelengths, at the end of the war Covington proposed to use converted radar equipment operating at a wavelength of 10.7 cm to probe the galactic center using the Sun's decimetric emission as a calibrator for deriving the cosmic-noise spectrum. His first attempts to measure the integrated flux over the solar disk in July 1946 did not produce consistent flux levels from day to day. The sun was quite active with large sunspots, so Covington was uncertain whether his instruments, local interference, or the Sun caused the daily variations, and he struggled to interpret these inconsistencies. Charlotte Covington, his wife, pointed out that a forthcoming partial solar eclipse would be visible from Ottawa on 23 November 1946. Covington seized this chance to measure the solar flux variations as the Moon occulted a large sunspot. In that single observation, he provided the first decisive proof that dark sunspots are associated with discrete hot sources of decimetric radiation. Over the next year of uninterrupted daily measurements of the integrated flux, Covington established that the variability of the 10.7-cm flux closely matched that of the sunspot numbers. Both measures were modulated by the comings and goings of active regions and the solar rotation.

Covington's groundbreaking studies of what came to be called the ''slowly varying component of solar radio emission'' quickly took advantage of other wartime developments at NRCL. A unique combination of a 46 m-long slotted wave-guide and two parabolic cylinders, erected in 1951 south of Ottawa, was the first device built in Canada to detect radio emissions from discrete astronomical sources. It was one of the earliest compound microwave interferometers; its narrow fan beam enabled Covington and N. W. Broten to measure solar limb brightening and the temperatures above isolated sunspots. With W. J. Medd, Covington began a series of experiments in the early 1950's to improve the relative and absolute accuracies of the daily observations of integrated Solar radio flux. In the process, they laid the foundation for future confidence in the daily 10.7-cm flux as an objective index of solar activity.

Arthur E. Covington, 1913–2002
*Photo courtesy of Eric Covington*

Over the next decade, these early successes paved the way for the NRC to establish the Algonquin Radio Observatory for galactic and solar astronomy at a remote radio-quiet site beside Lake Traverse, Ontario. Covington chose to continue with solar research for the rest of his career. He had, from the beginning, grasped the practical importance of solar-terrestrial research using the 10.7-cm flux as a proxy for ionizing solar radiation. The ever-growing list of applications for the daily 10.7-cm flux is a tribute to Covington's persistence in raising the quality of the measurements to the highest standards. The monitoring program was extended long past his retirement in 1978. The program, now in its 54th year, continues at the Dominion Radio Astrophysical Observatory near Penticton.

Covington's colleagues at NRCL honored him, shortly after he retired, by erecting a unique sundial at a site overlooking the building where he pursued his solar researches for over 25 years. It is an 0.9-m paraboloidal reflector supported on a framework of 10-cm wave-guide, with a 10-cm dipole feed at the focus as a gnomon.

Covington never forgot that his youthful passion for astronomy was nurtured among amateur enthusiasts in the Royal Astronomical Society of Canada. He contributed generously and with evident pleasure in many ways to the Ottawa Centre throughout his career.

Beneath Covington's reserved, orderly exterior there laid a quirky sense of humor and a generous spirit. He was fascinated by arcane topics as well, such as religious mysticism, especially if they had a solar connection. He was an avid collector of books, new and old, that reflected his wide-ranging interests, particularly in the history of radio science and the interrelationship of astronomy with other disciplines. He and Charlotte set up the Riche-Covington Trust at Queen's University, Kingston, to house his collection on the development of radio science in Canada. He leaves these tangible legacies, but his many friends will fondly remember him as much for his devotion to his family and to solar science.

Victor Gaizauskas
Herzberg Institute of Astrophysics (Editor's Note: A similar obituary appeared in the *Journal of the Royal Astronomical Society of Canada*.)

**MERTON EDWARD DAVIES, 1917–2001**

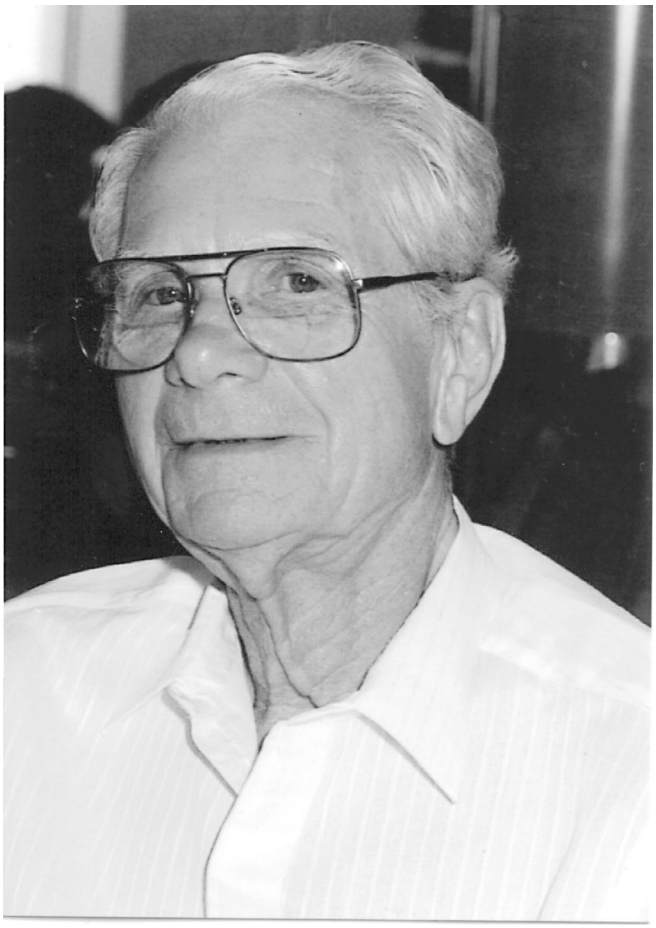
Merton E. Davies was a great friend to all who knew him. The diversity of that large group of fortunate people reflected the wide range of his professional and personal interests.

Born in St. Paul, Minnesota on 13 September 1917, Davies was the youngest of the three children of Albert Daniel and Lucille McCabe Davies. Soon after his birth, the family moved to Palo Alto, California, where Davies received an AB in mathematics from Stanford University in 1938. He taught mathematics for two years at the University of Nevada, but was then absorbed as a mathematics group leader in aviation development at Douglas Aircraft as that corporation geared up for World War II.

Mert, as he was known to everyone, joined the RAND Corporation in 1947 and remained on the RAND staff for the rest of his life. He began his career in military reconnaissance. In the early 1950s, he was a key contributor to the development of the CORONA system, which became the world's first reconnaissance satellite. The first pictures taken of Earth from orbit were reconnaissance photographs registered on a roll of film that was returned to Earth on 18 August 1960 in a CORONA capsule.

Mert was one of the ten founders of the National Reconnaissance Office, an agency of the Department of Defense. He received the George W. Goddard Award in 1966 for his ''distinguished contributions to the development of photoreconnaissance.'' He became a valued consultant to the United States Arms Control and Disarmament Agency.

This top-secret work for the military was a prologue to Mert's highly productive career as a major player in the Golden Age of planetary exploration. He understood immediately that his pioneering work on space photography could be applied to his keen interest in the moon and planets. By 1958, just two years after the successful launch of the Soviet Sputnik, Mert had already written a report about methods for obtaining pictures of the moon from a spin-stabilized spacecraft. When the opportunities for deep space missions arrived, he was ready to use his expertise in photogrammetry to start the systematic mapping of the planets and their satellites. This led to a his participation in a long series of NASA missions, making him the only person on Earth who had made virtual visits to every planet in the solar system save Pluto, for which there were no missions in his lifetime.



Merton E. Davies, 1917–2001
*Photo courtesy of M. Randel Davies*

Mert's contributions to these missions were instrumental to their astounding successes. Before launch, he participated in the design of the camera systems and the development of imaging strategies. When the data came in, it was Mert who established the coordinate systems for all of the target objects. The maps we have of Mercury, Venus, Mars and the satellites of the outer planets are all based on his work in establishing the point of zero longitude or the prime meridian for each object. As Bruce Murray has commented, to do so for even one such object would be a ''major career achievement by any scientist,'' but to be credited for having done so for essentially every large solid object in the solar system except Earth and Pluto provides ''an instructive lens through which to view Davies accomplishment.''(EOS, 82, 46 (13 November 2001):551-552.)

Recognizing that there was no scientific society overseeing this activity, Mert became the founding chairman of the IAU/IAG Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites in 1976. At about this same time, he became a member of the newly

created task groups reporting to the IAU Working Group for Planetary and Satellite Nomenclature. In that capacity, he helped to name the new moons and the myriads of surface features revealed on planets and satellites by the missions in which he participated. He remained active in all of these groups until his death, leaving a legacy of maps and coordinate systems that are likely to endure forever.

In recognition of this work, he received the Talbert Abrams award of the American Society of Photogrammetry in 1974 and in 1999, he became a fellow of the American Geophysical Union.

Any listing of Mert's accomplishments cannot do justice to the full measure of the man. He was exceptionally warm and generous, with a fine, friendly sense of humor. These characteristics were especially evident in his highly successful interactions with Soviet colleagues during the long, tense period of the Cold War, but were also of great benefit to those of us struggling with each other over the instrument parameters and scientific objectives on those marvelous planetary missions.

Mert liked to say that ''the essence of exploration is finding answers for which there are no questions.'' The openness to new perspectives that this remark reveals was indeed one of his great attributes. His career spanned the era in which our knowledge of the planets and their satellites changed from speculation about fuzzy telescopic images or simply moving points of light in the night sky to a deep appreciation of the nearby worlds in our planetary system. He gave us the maps that allow us now to explore these worlds and seek out their wonders. We only wish he could be with us as we follow the paths he provided.

In 1946, Mert married Margaret Louise Darling. Their marriage was blessed with three children, Deidra Louise Stauff, Albert Karl Davies and Merton Randel Davies, all of whom survive him with their mother. Davies passed away in Santa Monica, California on 17 April 2001 following complications from surgery.

Tobias Owen
University of Hawaii
Institute for Astronomy

## LAWRENCE DUNKELMAN, 1917–2002

Lawrence Dunkelman was a pioneer in the development of ultraviolet detectors and optical materials for use in scientific research. He applied these devices to astronomical and geophysical problems and played a significant role in developing the techniques and procedures necessary to make scientific optical measurements in space. Larry died in Tucson, Arizona on 27 January 2002.

Larry Dunkelman was born on 28 June 1917 in Paterson, New Jersey, a first generation American son of Eastern European Jewish immigrant parents who met and married in the United States. His mother, Yetta (née Kahn) Dunkelman was a Latvian émigré who immigrated to London as a young woman and eventually arrived in New York. She worked in Paterson as a seamstress and tailor, while his father, Max, an émigré from Poland, was a supervisor of silk loom weavers in Patterson. Larry obtained a degree in electrical engineering from Cooper Union in 1938 and went to work at the

Lawrence Dunkelman, 1917–2002
*Photo by Olan Mills, courtesy of Maxine and Sylvia Dunkelman*

Naval Shipyard at Portsmouth, New Hampshire. Three years later Larry was transferred to the Bureau of Ships in Washington, DC. On 7 December 1941 he arrived in Washington DC with orders to report to Hyman Rickover for duty that lasted for the duration of the war.

In 1947 Larry joined the Optics Division of the Naval Research Laboratory to pursue his interest in the use of ultraviolet and infrared devices for secure ship-to-ship signaling and for night-time surveillance. Not long afterwards, Richard Tousey began his program of ultraviolet solar spectroscopy using captured V2 rockets and Aerobee sounding rockets. Larry volunteered to take on the important task of making careful ground-based spectrophotometric measurements of the solar irradiance in the 0.3 to 0.4 micron region to provide a tie-point between the ultraviolet rocket measurements and conventional ground observations at longer wavelengths. A site on Mount Lemmon near Tucson was selected as being relatively pollution-free and photometrically stable.

The observing plan was extended to cover visible wavelengths into the near-infrared. Larry and his associate, Reuben Skolnick, used a double-beam spectrophotometer with a thermally stabilized photomultiplier referenced against a lamp calibrated at the National Bureau of Standards as the radiance standard. The solar measurements were made over large ranges of zenith angles to correct for Rayleigh scattering and extrapolate the results to outside the Earth's atmo-

sphere. These measurements remain as some of the best that have ever been made of the Sun's spectral irradiance, and they have the added value today of establishing a historical background value of Earth's atmospheric aerosol loading before the mid troposphere became significantly polluted due to industrial sources and increasing desertification.

In the early 1950s Larry perfected a series of middle-ultraviolet broad-band transmission filters which he incorporated into a small rugged photometer suitable for flight on a sounding rocket. He used these devices in collaboration with Albert Boggess to make photometric measurements of bright stars and planets in the 0.2 to 0.3 micron region. The results pointed to a revision of the temperature scale for hot stars and provided the first measurements of interstellar scattering in this wavelength range, leading to new models of interstellar dust.

After NASA was formed in 1958, Larry joined the newly established Goddard Space Flight Center where he led the group charged with developing ultraviolet detectors and optical materials. His long association with both military and commercial research in these fields enabled him to make rapid progress in sponsoring the development of new cathode materials and interference coatings.

All the early NASA astronomy sounding rocket flights, the OAO series of satellites, IUE and at least one HST instrument all carried optical components directly traceable to Larry or his commercial suppliers.

In later years Larry became increasingly interested in finding ways to make constructive scientific use of the manned space flight program. He worked closely with groups at the Johnson Space Center to promote an understanding of the objectives and requirements of science projects, particularly those involving optical observations of astronomical or atmospheric phenomena. He advised the Manned Spaceflight Program on the selection of photographic equipment, films and processing techniques. Larry also provided expert advice on the best ways to observe faint sources such as airglow, gegenschein and aurorae. Many valuable images of these phenomena, as well as observations of the Earth's limb at different solar angles, were obtained. Many scientists who have obtained data on manned space flights have benefited from Larry's efforts to make the manned space program responsive to scientific needs. Larry maintained an active interest in a wide variety of related subjects, including Operational Research investigations at George Washington University, and spent sabbaticals at the Institute for Defense Analysis as well as the University of Arizona's Optical Sciences Center.

Larry retired from NASA in 1977 and subsequently moved to Tucson where he was appointed an adjunct professor in the Optical Sciences Center. He continued his research in airglow, aurorae, and monitoring the optical effects of atmospheric pollution, remaining active in these fields for the rest of his life.

Among Larry Dunkelman's most important attributes were his infectious sense of humor and his irrepressible joy of life. He had an insatiable curiosity about the universe and all that is in it. It was impossible to be with Larry and not share his enthusiasm for all aspects of nature. He had a great talent for persuading those around him to participate in his many projects. He was a conversationalist par excellence and took great pleasure in knowing people; colleagues and casual acquaintances alike were rapidly converted into life-long family friends. Larry had a particular affinity for young people. He approached them as equals and invariably treated them with respect, involving them in his observing and monitoring programs, subtly acting both as mentor and role model. He awakened a love of science in most of his young friends and inspired a number of them to pursue careers in the physical sciences.

Larry is survived by Sylvia, his wife of 52 years, by his son Brett, daughter-in-law Annette and grandchildren Andrea and Michelle, and by his daughter Maxine and her partner Ray Philen, as well as many colleagues who continue to remember and admire him.

I wish to thank Glenn E. Shaw and Robert D. Mercer for contributing valuable information about Larry Dunkelman's life and career for this obituary.

Albert Boggess
Boulder, Colorado

## EDWARD RYANT "NED" DYER, JR., 1918–1999

Edward Ryant ''Ned'' Dyer, Jr. was the son of Rev. Edward Ryant Dyer, an Episcopal missionary and clergyman. His mother, Dr. Ann (née Humphreys) Dyer, studied medicine and obtained a medical degree. She met his father when they both were missionaries in China in 1913. Ned was born in Wuxi, China, on 1 February 1918 and was raised there for the first ten years of his life. As a child, Dyer developed an interest in astronomy from books in his father's library, especially those by James Jeans and Arthur Eddington. He attended preparatory schools in the United States, and eventually entered the University of Virginia in the 1930s, receiving a Bachelor's degree that combined astronomy, physics and mathematics in 1938. After graduation Dyer continued in astronomy at Vanderbilt University, receiving a Master's degree in 1940. He studied physics for another year but then was called to active military service in 1941, having trained in the Marine Corps Reserves. During the war Dyer worked mainly in the Washington offices of the Marine Corps and as a flight instructor at Pensacola. He was in the Philippines in August 1945 and was then transferred to duty in Peking, China where he served as the Marine Corps Provost Marshall for the area.

Dyer wanted to return to astronomy and did so when A. N. Vyssotsky offered him an acting assistant professorship at Virginia to allow him to complete his graduate degree. Dyer re-entered graduate school in 1946 and obtained his PhD in 1948, working on stellar population problems by studying the distribution of red giants. That work earned him a Carnegie postdoctoral fellowship at Mount Wilson, where he worked with Walter Baade. His assignment from Baade was to collect radial velocities of red stars, data which he brought back to Virginia when he received a permanent faculty appointment. In the mid-1950s, Dyer's wife, Jo Ann (nèe Severance) Dyer, campaigned to move to Washington, D.C. where she sought better career opportunities. Dyer accepted an appointment at Georgetown University in 1957. He taught

practical astronomy and celestial mechanics there, mainly, as he recalls in an oral history, to local military personnel who desperately sought out training in the wake of Sputnik. Father Hayden at Georgetown had obtained a large military contract for geodesy work; Dyer was hired to meet the increased teaching load associated with that contract.

The proximity of the National Academy of Science (NAS) and men like Hugh Odishaw and Ross Peavey proved to be an attraction for Dyer. He moved to the NAS in a staff position in January 1959 just as the new Space Science Board was forming. Dyer had prior contact with Board work, since he had been invited to be on its working group for geodesy; he became the secretary of that group. The working atmosphere of his new office appealed to Dyer, though it soon turned into ''quite a bureaucracy.'' Dyer experienced the heady first year or two of the Board's life when it felt empowered to act as clearinghouse for space science research in the United States. That atmosphere prevailed until the National Aeronautics and Space Administration (NASA) moved into a position of dominance under James Webb.

In the early 1960s, Dyer served in a group of NAS staffers who acted as liaisons between the Space Science Board and various advisory committees of the NASA. ''Here comes the spy'' his NASA Headquarters counterparts would quip. Dyer acted as liaison for astronomy, and recalled others like Herb Friedman as strong allies. He felt that NASA generally heeded the Board's suggestions but was also keenly aware that for men like Webb, ''science was going to take a back seat'' at NASA ''and not to worry about it.'' Dyer also felt that the leaders of the Space Science Board, especially Lloyd Berkner, were generally adept at finding ways to keep science alive under these conditions. Berkner, especially, ''was a politically skilled organizer of scientific enterprises.'' Berkner maintained a close relationship with Webb that made it easier for people like Dyer to get their views aired, and their jobs done successfully.

Dyer's continuing duties with the Space Science Board included acting as liaison to the Committee on Space Research (COSPAR), which brought him into contact with the State Department. He remained on the Board staff until 1968. After that period Dyer moved into the area of solar-terrestrial physics through his contacts with various organizations such as the U.S. National Committee for the IAU.

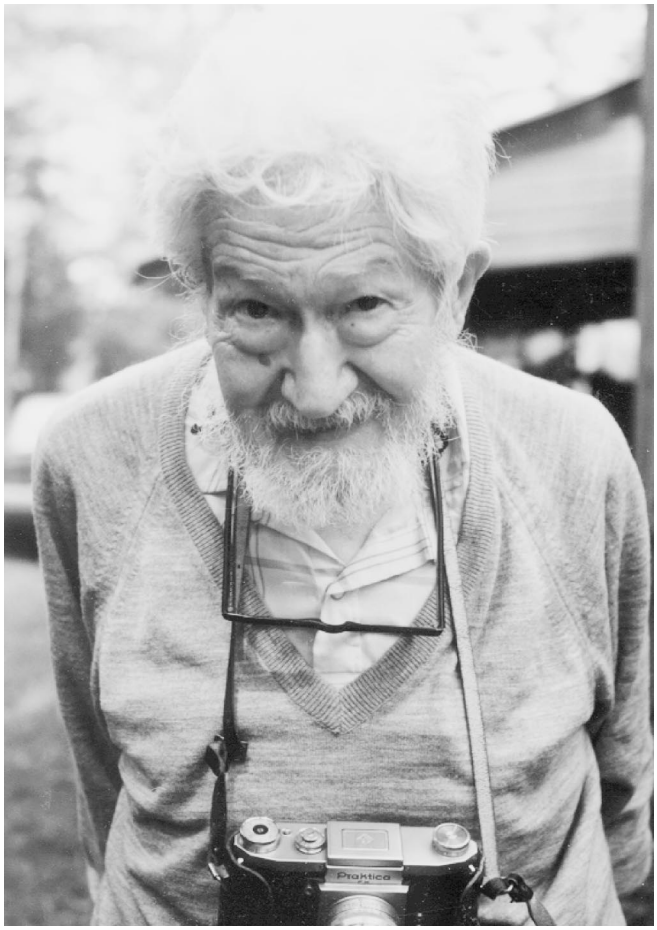
Dyer remained with the National Academy until his retirement in 1983 working in numerous capacities. He acted as Executive Secretary of the U.S. International Year of the Quiet Sun (IQSY) and maintained important liaison duties with the President's Science Advisory Committee (PSAC), NASA, National Science Foundation, and other private and federal organizations. He was the NAS Secretariat representative on the NASA Astronomy Steering Committee and also the Scientific Editor of NAS annual report to COSPAR. Other duties included staff officer for the Geophysics Research Board's Committee on Solar-Terrestrial Research and its panels on the International Magnetosphere Study and Middle Atmosphere Program. Dyer was also the secretary of the Panel on World Data Centers of the International Council of Scientific Unions. He retired from the NAS in April 1983 and died 12 October 1999. His wife Jo Ann and daughters Barbara and Virginia Dyer survive him.

The primary source of biographical data for this obituary was an oral history interview taken on 4 August 1988 and archived at the National Air and Space Museum. The interview focused on the Iowa 1962 summer study, and so was weak in other areas. Supplemental information was kindly gathered from NAS sources by Janice Goldblum, NAS Archivist, and from an obituary notice by Joe H. Allen in the International SCOSTEP Newsletter, Volume 2. Number 4, December 1999. Unfortunately, the AAS was unable to contact the Dyer family.

David DeVorkin
National Air and Space Museum, Smithsonian Institution

## JOHN (JACK) MASON GRANT, 1912–2002

Jack M. Grant, as he preferred to be known, a long-time Canadian meteor astronomer, passed away in Orillia, Ontario on 5 March 2002. His father, Lewis John Mason Grant was an artist, while his mother, Daisy Constance Hilda (née White) Grant, devoted herself to maintaining the household. Lewis was independently wealthy; a family fortune had been amassed farming indigo in India during the period of Queen Victoria's extended mourning and his modest inheritance was sufficient to support the family. Both parents engaged in home schooling for their children and created a rich intellectual climate for the family. Jack, their oldest son, was born in




John M. (Jack) Grant, 1912–2002
*Photo courtesy of Daisy M. O. Grant and Anna Grant LeBourdais*

Toronto on 25 September 1912. In 1914, Lewis and Daisy moved to a heavily forested fifty-three acre farm in Severn Township near Orillia, where Lewis did some farming but mainly continued his artistic pursuits.

Adept in mathematics and science and brought up under the dark night skies in rural Ontario, it was thus natural that Jack would learn to make his own reflecting telescope and became an amateur astronomer. He exhibited that intimate knowledge of the sky that often defines the serious amateur. While functioning as an amateur, Jack met and was strongly influenced by Peter Millman, who was at the University of Toronto at the time. Millman's influence was no doubt responsible for Jack's lifetime interest in meteors. Wartime service in the Royal Canadian Air Force, in the field of aerial photography, provided an opportunity to attend the University of Toronto, where Jack studied astronomy. After graduation Jack joined the staff of the Dominion Observatory in Ottawa and was soon posted to the Meanook Meteor Observatory at Meanook, Alberta. From 1954 to 1970 he was in charge of the meteor observations at Meanook. Many of the most detailed meteor spectra obtained at that time were recorded at Meanook, together with the nearby Newbrook Meteor Observatory.

Jack was also involved in three Alberta meteorite falls. He conducted many of the interviews with witnesses to the important Abee fall in 1952. Jack found a fist-sized piece of the large Bruderheim event in 1960 and he found the ''main mass'' of the Vilna fall in 1967, a small fragment retrieved from the snow on a frozen lake weighing only 0.094 gram. When the Alberta stations were closed, Jack continued in similar observational projects near Ottawa until retirement in 1977.

As a student of scientific history, Jack Grant had a comprehensive knowledge of many subjects. A cloudy interval during an observing session was quite rewarding if Jack could be persuaded to talk about the early history of photography, polar exploration, ballooning or aviation. (One should distinguish carefully between the first powered, heavier-than-air flight and the first controlled, powered, heavier-than-air success.) Jack mastered several foreign languages. In the post-Sputnik period he taught himself to be a competent translator of scientific Russian. Although he had a retiring nature, Jack maintained many strong friendships among his scientific colleagues.

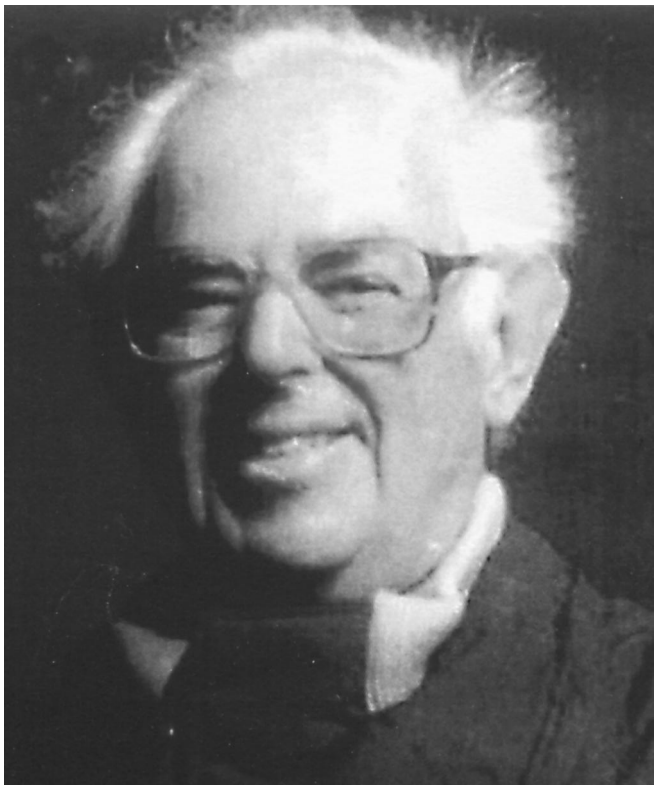
Jack Grant was a lifelong bachelor and is survived by two brothers, William Maling Grant and Oliver Montague Grant.

Ian Halliday
Ottawa, Ontario

## JEROME MAYO GREENBERG, 1922–2001

J. Mayo Greenberg, a leading experimental astrochemist and expert on cometary structure and composition, died of pancreatic cancer in his home in Leiden, The Netherlands, on 29 November 2001. Though born in Baltimore, Maryland on 14 January 1922, and educated at Johns Hopkins University, Greenberg had immigrated to The Netherlands in 1975, and it was there that his cometary expertise matured.

Greenberg was an exceptional child, entering Johns Hopkins University to study physics when he was only fifteen years old, and advancing to graduate studies, also in physics, in just over two additional years. His academic career was interrupted by war-related research during the 1940s, but Greenberg returned to Johns Hopkins to complete his PhD in 1948 with a dissertation on the scattering of radiation by matter. During his academic career in the United States, Greenberg held appointments at the University of Delaware, University of Maryland, Institute for Advanced Study at Princeton, Rensselaer Polytechnic Institute, Dudley Observatory and The State University of New York at Albany, where he served as chairman of the physics department.



J. Mayo Greenburg, 1922–2001
*Photo courtesy of Mrs. Naomi Greenberg*

Greenberg's interests gradually broadened from theoretical to experimental work while at the same time his interest in astronomy, in particular the problems related to how scattering processes polarized, reddened and blocked light in space, continued to deepen. A sabbatical year, and a year as a visiting professor, both at Leiden and in close contact with Henk van de Hulst and Jan Oort who had similar interests, were sufficient to persuade Greenberg that relocation to The Netherlands would be of interest. When van de Hulst persuaded Leiden University to invest in a chair for laboratory astrophysics, Greenberg was a natural choice for the position. Greenberg moved to The Netherlands in 1975, and resided in Leiden for the remainder of his life. Until his retirement in 1992, Greenberg was director of the Huygens Astrophysical Laboratory at Leiden University.

At Leiden, Greenberg's achievements included the laboratory synthesis of complex organic molecules from smaller molecules under laboratory conditions simulating those prevailing in space. He went on to demonstrate that such molecules evolved into even more complex refractory organic

molecules when exposed in space to the actual radiation that exists there. Samples of laboratory produced ''yellow stuff'' changed, after exposure in actual space conditions, into a dirty brown colored material. Space missions to Comet Halley determined that this color emulates the actual surface of that comet, while spectroscopic studies confirm that the two exhibit similar molecular structures.

The question of the possible origin of life on earth as we know it fascinated Greenberg. In his laboratory he was able to demonstrate that space conditions not only permitted the synthesis of complex molecules on the surface of dust particles, but also that those molecules could be produced in stereospecific forms by the strong, circularly polarized ultraviolet radiation in dusty gas clouds surrounding neutron stars. The recent discovery of stereo-specific forms of organic molecules in space provided a solid confirmation of this elegant laboratory research.

In the past quarter century, as George K. Milley described it in an internet tribute to Greenberg posted immediately after he died, ''the laboratory that Greenberg created has produced a constant stream of fundamental research papers, and cultivated a series of brilliant students who have gone on to be scientific leaders themselves. Although the Leiden Laboratory was the first such facility, there are now several comparable laboratories throughout the world, some of which are led by ex-students or staff of the Leiden Lab.''

In 1947, Greenberg married Naomi Slovin, who survives him together with their two daughters, two sons and grandchildren.

This obituary essay is drawn from both a copy of Milley's internet tribute ( http://www.strw.LeidenUniv.nl/mayo.mayo.html) provided by Naomi Greenberg, and from a lengthy and excellent obituary published in the *International Comet Quarterly* (Marcus, Joseph N. J. Mayo Greenberg (1922–2001), 23, 4(2001 October):153-155). The latter covers Greenberg's extensive contributions to comet theory and provides a useful list of relevant technical literature in astronomy, astrophysics and astrobiology.

Thomas R. Williams
Rice University

## KAREN LORRAINE HARVEY, 1942–2002

Two days after completing her last research paper, Karen Lorraine Harvey died of complications associated with cancer on 30 April 2002. She earned international recognition for her wide-ranging work on solar magnetic fields and solar activity. Her friends knew her as a warm, generous, energetic woman who admirably balanced her scientific achievements with devotion to family, service to the professional community, and fostering the careers of younger colleagues.

Karen was born on 26 December 1942 to Marilyn and Ellwyn Angle in Rapid City, South Dakota. Karen's mother was a nurse and homemaker. Her father, an aerospace engineer, sparked her interest in science when he bought her a small telescope that she used as a teenager to study sunspots.

In 1960, Karen made only the eighteenth observation of a white light flare since their discovery 101 years earlier, resulting in the first of her more than 120 published research papers. Karen's future husband, Jack Harvey, happened to observe the same flare in H$\alpha$ at Lockheed Solar Observatory, where he was working part-time while studying astronomy at the University of California at Los Angeles. Shortly after this, Karen also entered UCLA, but Karen and Jack did not meet frequently until the next summer when they both worked part-time at Lockheed.

Karen L. Harvey, 1942–2002
*Photo courtesy of Jack Harvey*

The UCLA astronomy department was not supportive of either solar physics or women in astronomy, but Karen, with perseverance instilled by her mother, earned a BA degree in 1964. She continued working at Lockheed as an independent contractor supported by grants, often obtained by her career-long friend and collaborator, Sara Martin. During the summers of 1965 and 1966, Karen worked for Bill Livingston in the Solar Division of Kitt Peak National Observatory (KPNO) as a summer student. In addition to establishing enduring professional associations and friendships in the hospitable environment at KPNO, Karen renewed a deepening friendship with Jack, who was collecting data on Kitt Peak for his PhD dissertation; they were married in 1968. In 1969, after completing an MS degree in the woman-friendly UCLA Meteorology Department with a thesis on ionospheric effects of solar flares, Karen became a long- term, unpaid visitor at KPNO, where Jack had taken a staff position. A few small grants and contracts provided Karen with some funding.

Karen continued to study flares using both magnetic and velocity field data in the early 1970s, often in collaboration with Sara Martin. Nurtured by hours of flare patrol observing, Karen had an exceptional ability to forecast flares. She usually succeeded in getting valuable flare observations,

even with the small fields of view afforded by the instrumentation of the time, because she accurately scheduled KPNO observing time months ahead by using active longitude clues. Karen also studied the individual and statistical properties of small-scale active regions (named ephemeral active regions by Helen Dodson-Prince of McMath-Hulbert Solar Observatory), including their association with the newly-discovered X-ray bright points and HeI 1083 nm dark points. After many follow-up studies, Karen became arguably the world's leading authority on ephemeral regions and their role in the solar activity cycle.

Karen and Jack's son, David, was born in 1974, and for several years thereafter Karen devoted most of her prodigious energy to motherhood. To nourish her continuing strong interest in solar physics, Karen volunteered to produce an index for *Solar Physics*. Using subject headings provided by the journal's editorial board, she produced three short indices for the first 40 volumes and then published a full index for volumes 1 55 with refined subject headings. Characteristically, Karen continued to compile indices for more than twenty years (through volume 197), long after her successful research career would have justified passing that responsibility to others. She may be the only person to have read every one of the thousands of papers in *Solar Physics*.

Karen incorporated as Solar Physics Research Corporation in 1978 because NASA required a corporate entity to receive funding for one of her research proposals. Her one-woman business continued quietly until 1992 when, as a favor to the National Solar Observatory (NSO), she started adding other scientists, including D. Braun, Y. Gu, H. Hudson, J. Jefferies, C. Lindsey, S. Martin, A. Takeda, K. Topka, O. R. White, and others looking for a temporary scientific home. Although Karen might not have thought of herself this way, she was an entrepreneur in the best sense of the word: someone who pioneered, persevered, and succeeded in the harsh arena of independent science while furthering the careers of others.

Despite her increasing reputation in the field of solar physics, Karen felt the lack of the conventional formal credential, a doctoral degree. In 1984, she began a massive study of the magnetic properties of active regions and ephemeral regions under the guidance of Kees Zwaan of Utrecht University. It took nearly nine years to complete what turned out to be a substantial series of papers that addressed many fundamental properties of active and ephemeral active regions through the solar cycle, including their size-distribution, total and net magnetic flux, and north-south asymmetry. Her friends and colleagues understood—better than Karen herself—the courage and determination it required to seek a PhD in mid-life and mid-career; earning it was a highlight of her professional life.

While conducting her dissertation research, Karen chaired one of several working groups formed to conduct a series of workshops on the solar cycle. In 1991, the forth of these workshops, which she organized and conducted at NSO/Sacramento Peak, attracted more than 70 scientists from all over the world. Karen edited the resulting conference publication, which contains an unusual number of significant contributions.

Karen was a co-investigator on the US team that participated in the development and operation of the SXT instrument on the Yohkoh satellite. This role resulted in several happy and productive trips to Japan and numerous papers with Japanese and US scientists on various types of X-ray events and their associated magnetic fields. Many other collaborations, most recently with a group interested in filaments and their connection with the solar cycle, attracted Karen's participation. Because of her natural inclination to help and work with others, she numbered more than 150 scientists among her co-authors of published papers.

During the course of her three-year struggle with ovarian cancer, Karen worked mainly on two projects: trying to understand how various magnetic structures affect the Sun's total and spectral irradiance, and a thorough compilation of coronal hole properties and associations over a solar cycle. Characteristically, she provided other workers with the coronal hole data before she published her own analysis. The entire database is now publicly available according to her wishes.

Karen served the professional solar physics community throughout her career. She was elected treasurer of the Solar Physics Division (SPD) of the American Astronomical Society for six consecutive terms before retiring in 1995 after 18 years in this role. She also served on the SPD nominating and executive committees and was active in the SPD women's group. She enjoyed educational activities, appearing in an educational television program about the Sun and, shortly before her death, answering questions from students participating in the Internet Solar Week 2002 for young women. She contributed to a US National Research Council study of the field of solar physics and carried out an exhaustive study of demographics and funding. In January 2002, the International Astronomical Union honored Karen by naming asteroid 23884 after her. In May 2002, the SPD voted to establish the Karen Harvey Prize ''to recognize and encourage new talent in solar physics, and to recognize the contributions of Karen Harvey to the study of the Sun.''

Karen Harvey leaves a legacy of fundamental research shaped by her insight into solar magnetic fields, a natural gift strengthened by years of patient observation and analysis. She knew what was important and brought out the best in her collaborators. She overcame many obstacles in becoming a successful woman in solar physics, to the lasting benefit of the field. Above all, she relished life and lived it with zest, grace, determination, humor, and humility. Karen Harvey is survived by her husband John W. Harvey, her son, David, her parents, a sister and two brothers.

John W. Harvey
National Solar Observatory

Sara F. Martin
Helio Research Douglas

M. Rabin
NASA Goddard Space Flight Center

Oran R. White
Mancos, Colorado

## JAMES HARVEY HENSLEY, 1940–2002

James Harvey Hensley, a dedicated educator in astronomy and physics for over thirty years, died in Platteville, Wisconsin on 13 March 2002. He had been suffering from cancer since the spring of 2001.

Harvey, as he was known to his friends, was born on 15 May 1940 in Lexington, Kentucky. His father, Dr. William Allen Hensley was a chemist while his mother, Stella, was a registered nurse. Harvey earned his BS in physics from University of Missouri-Columbia in 1962 and an MS in physics from University of Missouri-Kansas City in 1967. He began teaching in the Physics Department at University of Wisconsin-Platteville in 1968, taking time off to earn a PhD in Science Education from the University of Iowa in 1974.

Harvey began his career as a high school physics and math teacher in Raytown, Missouri from 1962 to 1965. After completing his MS he became an assistant professor of astronomy and physics at the University of Wisconsin-Platteville, retiring as a full professor in 2001. He served as department chair from 1980 to 1992. From 1981 until his retirement he was also an adjunct professor at Governor's State University in University Park, Illinois, teaching weekend astronomy classes.

For thirty-four years at UW-Platteville, Harvey was committed to physics and astronomy education. He was a member of the American Association of Physics Teachers, the American Astronomical Society, the Astronomical Society of the Pacific, and the Astronomy Educators Association. He served on the AAS Education Advisory Board from 1989 to 1991 and was a member of the working group in astronomy education from 1990. Harvey was a member of the Wisconsin Society of Science Teachers and presented numerous workshops for elementary and high school teachers over the years. The past few years he was involved in research and course development in the calculus-based physics sequence, presenting the results of his work at both regional and national AAPT meetings.

Although he taught both physics and astronomy during his years at UW-Platteville, Harvey's first love was astronomy. Not only did he share his enthusiasm for astronomy with his students, but he also shared astronomy with seniors and children alike in Elderhostel and College for Kids, respectively. He was a frequent and favorite guest in the elementary and middle schools of the area, bringing both knowledge and entertainment to the classroom. He even took his love for astronomy to the airwaves, presenting a brief, weekly astronomy program on one of the local radio stations for a while.

For many residents of Platteville, though, their memories of Harvey center on his public viewings. Anytime there was a partial or total eclipse of the Sun or Moon, he would set up telescopes in front of the science building and literally beg people to stop and take a look. In thirty plus years he reached a lot of people that way. One such viewing stands out in my mind. I was out of town, but I heard about it in an unexpected way. In the summer of 1989 there as a full lunar eclipse over Platteville. Harvey had his telescopes set up as usual. But that day there were members of the national media present covering the Chicago Bears who were in training camp on campus. One of the reporters filmed Harvey in action, sent in the tape and it was played on national news the next evening. When I stopped in at my brother's house in Denver the next day, he informed me that he had seen UW-Platteville on national news. That's Harvey!

James Harvey Hensley, 1940–2002
*Photo by Olan Mills, courtesy of Lila Hensley*

Harvey did have other interests besides astronomy. He served as faculty advisor for the Phi Eta Sigma honor society for about ten years, and in that role he developed very close ties with many of the students on campus. He was a long-term member of the local Optimist Club serving as president for two years. He and his wife Lila were active supporters of the arts in the area, particularly the Wisconsin Shakespeare Festival at the university. And Harvey had a very visible hobby—his Porsche. He spent many hours caring for his car and studying about Porsches in general. He was an active member and officer of the Madison Region of the Porsche Club of America, and his physics lectures and tests were sprinkled with Porsche examples. For over thirty years his office on campus was a shrine to his two loves—astronomy and the Porsche.

Harvey is survived by his wife of thirty-nine years, Lila (née Baur) Hensley, their two children, David Allen Hensley and Melissa Ann Hensley.

Philip W. Young
University of Wisconsin-Platteville

## CHRISTOF LITWIN, 1949–2001

Christof Litwin, a theoretical physicist with broad interests ranging from field theory to plasma physics and astro-

physics, passed away suddenly and unexpectedly on 4 October 2001, from complications arising from surgery for oral cancer. Christof was a senior scientist at the University of Chicago, working within the Department of Astronomy and Astrophysics and the Center for Astrophysical Thermonuclear Flashes.

Christof's life and career mirror those of many European scientists who lived through the turmoils of the 20th century. He was born in Lodz, Poland on 15 June 1949. His father, Jacob, was a history professor while his mother, Eugenia, was a pediatrician. Christof received his pre-college education in Lodz and in Warsaw. However, to escape anti-Semitic strains which were prevalent in Poland at the time, the family moved to Sweden. To further his education in physics, Christof immigrated to Denmark. Because he had shown his talent in physics early in Poland, Christof received strong recommendations for study at the University of Copenhagen, where he enrolled, and received his Part I degree in Mathematics–Physics in 1972, and his Cand. Scienti. in Theoretical Physics from the Niels Bohr Institute in 1976. His thesis title was ''Dual Strings and Membranes,'' an early foray into string theory. After a postdoctoral period in the United States, he completed further requirements for his degree at Copenhagen, receiving his ScD in Physics in 1990.

Christof's postdoctoral training started in particle physics at Stanford University. From 1977 to 1980 he was a Research Fellow at SLAC, but he realized that his interests were turning to collective phenomena. He switched fields and became a research associate at the Cornell University Laboratory for Plasma Studies, where he worked closely with Ravi Sudan from 1980 to 1984. While at Cornell, Christof investigated a range of plasma problems, including the stability of the spheromak magnetic confinement configuration and turbulence and stability of tandem mirrors.

In 1984 Christof moved to the University of Wisconsin at Madison, where he stayed until 1996, performing seminal work in the departments of Physics and Engineering Physics on the effect of the ponderomotive force on the macrostability of a plasma. Christof's ideas invariably led him to interact strongly with experimentalists. He significantly influenced experiments at Wisconsin and elsewhere, some of which, e.g. a lower-hybrid wave injection experiment, are just now beginning.

The Wisconsin period did have one interruption: Christof served as a visiting associate professor in the Department of Nuclear Physics at the Weizmann Institute from 1989 to 1991. The trip to Israel was a signal event in Christof's life in two ways. It was there that he met his wife–to–be, Adi Altshuler. It was also at the Weizmann Institute that he began to pursue the third area of his physics interests, plasma astrophysics. Near the end of his stay in Madison, Christof spent some time at the University of Chicago as a visiting assistant professor teaching a course in plasma astrophysics in the Department of Astronomy and Astrophysics. He then made his final switch in field to astrophysics and in institution in 1997, when he became a senior research associate at the University of Chicago.

It was characteristic of Christof that he did not start with trivial problems: he realized that his plasma physics background could be put to good use in solving a significant solar physics problem. His choice as an entry problem was the transport processes in the solar corona that give rise to the observed highly structured magnetized atmosphere. Christof quickly worked out the consequences of existing laboratory-based transport theory for the solar corona and, in a landmark and often-quoted paper published in 1993 in the Astrophysical Journal, he provided a framework for further studies of this problem. His work continues to this date to define the research agenda in this field.

Christof Litwin, 1949–2001
*Photo courtesy of Adi Altschuler*

Although Christof continued to work, and publish, on the solar corona, he branched out to other fields. His publications in astrophysics included studies of the stability of accretion columns on neutron stars, the penetration of accreted plasma into the magnetosphere of compact stars, the acceleration of ultra–high–energy cosmic rays (UHECRs) due to cometary or asteroidal impacts in the magnetospheres of neutron stars, and the interaction between stellar magnetospheres and surrounding accretion disks. All of these studies bore the hallmarks of Christof's science: they focused on hard problems, and they proposed truly novel solutions.

What is not so evident from the paper record is the enthusiasm that Christof brought into his work, the inquisitive spirit, the nonconforming and always questioning attitude, and the Talmudic style of research. Those of us who worked closely with Christof can never forget his constant reexamination of calculations and of ideas of things we thought had been fully resolved but Christof could not leave be.

Christof's achievements were recognized by his peers: he

was named a NATO Fellow in Science (1977–1979) and was elected a Fellow in the American Physical Society in 1996. Even while hospitalized just before his death, Christof could be found actively engaged, as usual, in a wide variety of calculations, including the treatment of magnetic stochasticity on Alfven wave propagation and current drive in laboratory plasmas, and new computations of the propagation of UHECRs in the intergalactic medium. He had even set up his computer in the hospital room, and was busy responding to his email.

Christof possessed an unusual appreciation for the pleasures of life and a gentle wisdom about it, which he generously shared with his friends and colleagues. Speaking six languages, he had a love of conversation and literature. He leaves behind his wife Adi, an attorney and Director of International Programs at the Northwestern University Law School, their two young children, Yael and Yonatan, his mother, and his brother.

We miss him deeply.

Nathaniel J. Fisch
Princeton University

Arieh Konigl
University of Chicago

Stewart Prager
University of Wisconsin at Madison

Robert Rosner
University of Chicago

Gordon J. F. MacDonald, 1929–2002
*Photo by the International Institute for Applied Systems Analysis, Courtesy of Margaret S. MacDonald*

## GORDON JAMES FRASER MACDONALD, 1929–2002

Gordon J. F. MacDonald was born in Mexico in 1929, the son of a Scottish accountant. He never revealed to me how he managed to make the transition from schooling in Mexico to a highly successful student career at Harvard, ending with a PhD in 1954. I met Gordon first in 1959, in the home of Walter Munk, having been invited there specifically to meet this outstanding postdoc, who had written a book together with Walter, *The Rotation of the Earth*. This is not a trivial subject, as I knew, having worked in this field before. I was delighted with the book (still considered the standard work in this field), and delighted that it received a prize for clarity of exposition. Already, at this first meeting with Gordon, I went away with the feeling that I had met a young man of outstanding intellectual abilities. His wide-ranging knowledge was most impressive, as was his rapid understanding of difficult topics in physics.

From this meeting on Gordon and I remained in close contact. We discussed innumerable subjects over the years; we shared graduate students. He was the best person I knew with whom to discuss new ideas and many scientific topics of the day. He was always well informed, and always gave thoughtful replies.

After the creation of NASA in 1957, Gordon and I had many opportunities to meet and exchange viewpoints, having both been appointed by the White House and by NASA to various advisory committees about the space program. It was very interesting to observe on these committees how often the same groupings of the members emerged, even on totally different topics. I cannot recall any case where Gordon and I were on different sides of any debate.

Gordon's career was as varied as any I have known. He made important advances in the understanding of the Earth, both its interior and its atmosphere. He was elected at an early age to the various scientific academies and societies. He held appointments in high positions at universities as well as in defense related industries. He served as member and often as chairman of government committees, and was often responsible for writing the final document at the conclusion of such committees.

My first impression of him turned out to have been correct. There was here an outstanding intellect that could successfully encompass many different subjects. Luckily for science he had made that his first priority, but he would have gone far in many other fields he might have selected.

Thomas Gold
Cornell University

*Editor's Note: Professor's Gold's tribute to Gordon MacDonald is a personal one which does not lend itself to expansion to round out his tribute into an obituary. The following extension of Gold's essay benefited from information provided in several documents by Mrs. Margaret MacDonald:*

MacDonald was the son of Gordon and Josephine (née Bennett) MacDonald. The father had emigrated from Scotland to Canada. The Canadian bank that employed him as an accountant asked his father to move to their branch office in Mexico City. There, his father met Josephine Bennett, who

was working in the American Embassy, and they were married. Gordon J. F. MacDonald was born on 30 July 1929 in Mexico City. The family settled in San Luis Potosi, where MacDonald's early education was interrupted when he contracted polio. After his recovery from polio, MacDonald received several years of home schooling, and then completed his college preparation in Texas schools, becoming not only an outstanding student, but also an outstanding athlete as a football lineman. During his tenure at Harvard, MacDonald again played football and also rowed in intercollegiate scull racing. He graduated summa cum laude from Harvard in 1950 and earned an MA degree in 1952, also from Harvard, before completing his PhD there in Geology and Geophysics in 1954.

MacDonald's professional career was varied enough to defy accurate description in a chronological sense. In an attempt to provide some completeness while achieving brevity, that career will be discussed categorically rather than chronologically. His academic career included teaching, research and senior administrative assignments at MIT (1954–1958), UCLA (1958–1966), UC Santa Barbara (1968–1970), Dartmouth (1972–1983) and UC San Diego (1990 until 1996). He was the author or co-author for over 200 scientific articles and monographs; his most recent book is *Ice Ages and Astronomical Causes: Data, Spectral Analysis and Mechanisms* (2000) with Richard A. Muller. While at UCSD, MacDonald founded the *Journal of Environment and Development*, now the premier journal in this field.

Governmental service, both full and part-time, and with various pseudo-governmental agencies as well as with extra-academic organizations was an important part of MacDonald's career. He served on the original presidential Council on Environmental Quality (1970–1972); on the president's Science Advisory Council; as a member of the JASON group, and as chairman of MEDEA from 1993 to 1996. In MEDEA MacDonald led a group of scientists who addressed such controversial issues as the declassification of data obtained by classified systems for application to solving scientific and environmental problems. In 1964, the Central Intelligence Agency awarded MacDonald its highest civilian honor, the Agency Seal Medallion. MacDonald served as the MITRE Corporation's first distinguished visiting scholar (1977–1979), and was employed by MITRE as chief scientist and vice president from 1983 until 1990. He served as Director of the International Institute for Applied Systems Analysis from 1996 to 2000.

Honored frequently and well for his contributions to science and society, MacDonald's recognitions of special relevance to AAS include his elections to the American Academy of Arts and Sciences in 1959, to the National Academy of Sciences in 1962, and to the American Philosophical Society in 1963, and designation as a foreign associate of the Royal Astronomical Society in 1971. He received the James B. Macelwane Medal of the American Geophysical Union in 1965. MacDonald is survived by his wife, Margaret (née Stone)

MacDonald, three sons–Gordon James, Michael Andrew, and Bruce Scott–and a daughter, Maureen MacDonald, his sister, Barbara Pfiester, as well as five grandchildren.

Thomas R. Williams
Rice University

**PETER MEYER, 1920–2002**

Peter Meyer, a distinguished astrophysicist and pioneer in cosmic-ray observations, died in Chicago on 7 March 2002, after a stroke, following long illness. He was born in Berlin, Germany, on 6 January 1920, the son of Franz Julius Meyer, a Jewish physician, and Frida Luise (née Lehmann) Meyer, a nurse. Peter received his initial academic training at the Technical University in Berlin, with the famous physicist Hans Geiger as one of his teachers. He received a degree as Diplom Ingenieur in 1942 with a thesis on proportional counters. Because of his partial Jewish heritage, he was permitted neither to continue his studies towards a PhD, nor to have the ''honor'' of serving in the war. He survived as a factory worker, and after the war, enrolled at the University of Göttingen. With Wolfgang Paul (Nobel Prize in Physics, 1989) and Hans Kopfermann as his advisors, Peter received a PhD in physics in 1948, with a thesis on the precise measurement of the binding energy of the deuteron. He continued research in experimental nuclear physics in Göttingen, and as a post-doctoral fellow at the Cavendish Laboratory in Cambridge. From 1950 to 1953, Peter was a staff scientist at the Max Planck Institute for Physics at Göttingen.

In 1953, Peter came to the US and became a Research Associate of John Simpson at the Institute for Nuclear Studies (now the Enrico Fermi Institute) of the University of Chicago. He remained associated with this university for the

Peter Meyer, 1920–2002
*Photo courtesy of Dr. Patrica Spear*

rest of his life, although he accepted invitations for a number of extended research visits at the Max Planck Institutes in Garching and Heidelberg. He was appointed Assistant Professor of Physics at Chicago in 1956, promoted to Associate Professor in 1962, and to Professor in 1966. Peter served as Director of the Enrico Fermi Institute from 1978 to 1983, and as Chairman of the Department of Physics from 1986 to 1989. In 1990, he became Professor Emeritus.

As cosmic rays were a challenging topic at the intersection of nuclear physics, astrophysics, and emerging particle physics, Peter became interested in this subject during his early career in Göttingen, and contributed to the classic collection of review articles on cosmic radiation edited by Heisenberg in 1953. After coming to Chicago, cosmic ray studies remained at the center of his research until the end of his career.

Together with John Simpson, Peter conducted a number of measurements with instrumentation on balloons or on aircraft, to investigate the then mysterious variations of cosmic rays with time and with geographic location. It was not clear whether these variations were of solar origin, or intrinsic to the galactic radiation, or just due to phenomena in the earth's magnetic field and ionosphere. Important insight came from observations of a gigantic solar flare in 1956 which Simpson, Meyer, and Eugene Parker could only explain by assuming that interplanetary space is filled with plasma and varying magnetic field, strongly affected by solar activity. This idea led, subsequently, to the concept of the solar wind.

Peter also collaborated with Simpson on the design of some of the first cosmic-ray detectors flown in space. In parallel with this work, he started a research program that would lead to a long series of ever more complex cosmic ray detectors carried by giant stratospheric balloons. First, he tried to detect electrons in the cosmic rays. Their existence was inferred from observations of non-thermal radio emission from the galaxy, but was never proven directly, and the experimental obstacles were formidable. Peter, together with his graduate student Rochus Vogt, devised a new and completely electronic instrument, and succeeded in 1961, at about the same time that James Earl of the University of Minnesota reported the observation of electrons with balloon-borne cloud chambers. Electrons and positrons can be produced in about equal proportions by collision of protons with interstellar gas. The obvious question was then: Is there an excess of negative electrons that would indicate that electrons are also accelerated in primary cosmic ray sources? To test this, Peter, together with colleague Roger Hildebrand and graduate students Jack Fanselow and Robert Hartman, built the first magnet spectrometer flown on balloons, and could report in 1964 that, indeed, the negative electrons significantly outnumbered the positrons.

Detailed observations of cosmic-ray electrons, including electrons of solar origin or those accelerated in Jupiter's magnetosphere, occupied Peter and his group (including Jacques L'Heureux, Dietrich Hovestadt, and Paul Evenson) for the next two decades, using a variety of instruments, on balloons and in space.

In the 1970's, Peter directed his attention towards measurements of the nuclear composition of cosmic rays at very high energies. To this end, new particle identification techniques, such as gas Cherenkov counters, were applied, and with colleague Dietrich Müller and graduate student Einar Juliusson, Peter discovered that the relative intensity of secondary cosmic-ray nuclei produced by spallation of primaries in interstellar space, decreases continuously with increasing energy, as if the parent primary particle traversed a smaller and smaller galactic path length at higher energies. A similar observation was also made by Luis Alvarez' group at Berkeley at about the same time. As a consequence of this unexpected phenomenon, cosmic rays must be generated at their sources at a higher rate at high energy than the observed spectrum at Earth would imply: the energy spectrum emitted at the sources must be harder than that observed here. In the late 1970's, theorists finally proposed the first-order Fermi acceleration process in supernova shockfronts as an efficient mechanism to generate cosmic rays. This process predicted a hard-source energy spectrum for which the Chicago measurements provided the ready evidence.

Eventually, these studies led to a very large instrument, dubbed the ''Chicago egg,'' that flew on the Space Shuttle in 1985. This detector was designed by Meyer and Müller, who were later joined by L'Heureux and Simon Swordy. It used, for the first time, transition radiation detectors to measure the energy of cosmic-ray nuclei. With this instrument, details of the elemental composition of cosmic rays could be measured well into the TeV-region of energies.

Peter was convinced that observational progress is tightly coupled to experimental finesse. Throughout his career, he received joy and satisfaction from implementing new experimental techniques. He led a sizeable group of postdocs, technicians, and students who shared this conviction, respected his leadership and accepted Peter as a mentor in many aspects of their lives, not just the technical and scientific questions of research.

Peter was a principled man. He was modest, reliable, and dependable. He was very well read in classical and modern literature. His life was disciplined and structured, but had many facets. The workday belonged to the laboratory, but evenings were reserved for the family, and for his most serious passion, music. Peter was an accomplished cellist, and together with his first wife, Luise Schützmeister Meyer, who played the piano, he arranged for regular chamber music evenings in his home, which are fondly remembered by all who had the privilege of being invited to listen. Some remember in awe how Peter was able to combine smoking the pipe with playing the cello! Both Peter and Luise were avid skiers, and the yearly ski vacations and many other outdoor activities together with their two sons were important and cherished family traditions. After Luise's untimely death in 1981, Peter married the renowned molecular biologist Patricia Spear in 1983. The following year, Peter and Pat moved from the suburbs back into the city, close to the university campus. In their nineteen years together, they pursued many common interests in music, theater and the outdoors, and they traveled widely and often across the globe.

Peter served unselfishly on numerous science policy committees. He is remembered for his fairness, open mind, and good advice. He received a number of honors, for example,

the Quantrell teaching award at the University of Chicago, foreign membership in the Max-Planck-Institute for Extraterrestrial Physics in Garching, and the Alexander von Humboldt award for senior US scientists. In 1989, Peter was elected to the National Academy of Sciences. Many people met Peter over his long and distinguished career: professional colleagues, managers at NASA and industry, engineers and technicians, numerous students, including seventeen who received their PhD's under his advice. All of them will have fond and enduring memories of Peter as both a scientific leader and as a warm and caring human being. Peter Meyer is survived by his wife Patricia Spear, and his two sons Stephan and Andreas Meyer.

Dietrich Müller
University of Chicago

**RICHARD IRWIN MITCHELL, 1927–1990**

Richard Irwin Mitchell, astronomer and mathematician, passed away on 5 February 1990, in Albuquerque, New Mexico, after a long illness. He was the only child of Lawrence C. Mitchell and Helen (née Thompson) Mitchell and was born in Oakland, California on 1 February 1927. He went to Frick Jr. High and Fremont High School, both in Oakland. After graduating early from high school, Mitchell enlisted in the US Navy. He was discharged in 1946 as Electronics Technicians Mate Second Class.

On 22 December 1950 Mitchell married Mary E. Lundquist, now deceased, and they are survived by four children, Leslie Louise Senghaas, Mark Richard Mitchell, Gail Elizabeth Scott, and David Lawrence Mitchell, and four grandchildren.

Dick, as most of us knew him, received a BA in Physics in 1950 and an MA in Astronomy in 1955 both from the University of California at Berkeley (UCB). Later in 1955 he started his professional career in astronomy at the Lowell Observatory where he began an association with Harold L. Johnson that spanned more than 20 years of scientific research. As a result of his friendship and long association with Johnson, Dick collaborated in publishing over 30 astronomical papers covering many of the major fields of astronomy, particularly the fields of photometry of stellar clusters, infrared observations, and, more recently, photometry of bright stars. Dick was at the Lowell Observatory from 1955 to 1959, at the Department of Astronomy, University of Texas (UT), from 1959 to 1962, at the University of Arizona (Lunar and Planetary Laboratory from 1962 to 1969, and the Optical Sciences Center from 1969 to 1971), and at the McDonald Observatory, UT, from 1971 to 1974. Because of his expertise in astronomy and data processing, Dick was frequently called upon to teach university courses in astronomy, the physical sciences, and computer science, and did so at UCB, UT, and the National University of San Diego. At UT Dick also taught a graduate course in statistical astronomy with an introduction to computer programming fundamentals.

Throughout his career Dick was involved in a number of large astronomical research projects as an observer, as coordinator and supervisor, as teacher, and as data manager and computer programmer. He assisted with the creation of several stellar photometric systems. While working at the University of Arizona, Dick developed computer data reduction programs for UBVRI, 13- color, and infrared photometry. Those programs have received considerable use at a number of astronomical centers in the United States, México and Chile.

Richard I. Mitchell, 1927–1990
*Photocourtesy of Gail Mitchell Scott*

Dick had a long friendship and association with Mexican astronomers and astronomy. He was co-author, with Johnson, Braulio Iriarte and Wieslaw Wisniewski, of the ''Arizona-Tonantzintla Catalogue: Magnitudes and Colors of 1,325 Bright Stars'' (*Sky & Telescope* 30, 21-31, 1965). From 1974 to 1978, Dick worked at the Centro de Investigación Cientifica y Educación Superior de Ensenada, Baja California, México, as an assistant professor and manager of the computing center. Under his supervision and direction this center grew into a full department of computer science. When he left in 1978, this department was completely managed and staffed by Mexican personnel, many of whom were previous students of Dick. While in Ensenada, Dick also served as an adviser for a number of astronomical projects at the Observatorio Astronómico Nacional at San Pedro Mártir. Dick was always a very good friend to students and astronomers from the Mexican universities and observatories. He was always patient and available with ideas, advice, and encouragement. Over the years he was an acknowledged mentor to several PhD and MS theses.

Dick's help and encouragement were the key to my finishing quickly and thoroughly a PhD dissertation at the University of Arizona. He always regretted not having obtained a PhD himself, due mainly to his inability to master a foreign language.

After 1978, Dick worked for the BDM Corporation and was involved mostly with the management and computer programming for various government projects. However, he never lost his strong interest in astronomy. During 1983-1984 he participated as Adjunct Lecturer in the Senior Advanced Seminar in Astrophysics at the University of Nevada, Las Vegas. In 1985, Dick published one of his last papers, ''Solar Colors on the 13-Color System,'' in the *Astronomical*

*Journal* (Volume 90, p.2116). In October 1989, Dick realized that the end was near and donated his personal computing facilities for the reduction of astronomical images, and his extensive collection of scientific books and journals to the Observatorio Astrofísico Guillermo Haro at Cananea, Sonora, México. A significant part of that observatory's library is still that portion donated by Dick. To the end Dick Mitchell cared about and helped others. He will be missed!

William J. Schuster
Mexican National Astronomical Observatory

**LEONID M. OZERNOY, 1939–2002**

Dr. Leonid Ozernoy, a well-known astrophysicist trained in the former Soviet Union, died on 28 February 2002 after a long illness. Born on 19 May 1939 in Moscow, Leonid Ozernoy earned degrees in astronomy and physics from Moscow University. He received his doctorate in physics and mathematics in 1971 from the P. N. Lebedev Physics Institute in Moscow, where he worked as a senior research scientist from 1971–1986. He completed his dissertation under the guidance of Dr. Vitaly Ginzburg, one of the most senior Soviet astrophysicists.

Dr. Ozernoy was a prolific scientist with a broad array of interests in fields as diverse as cosmology, active galaxies and quasars, black holes, pulsars, and the evolution of the solar system. He made many fundamental contributions to these areas as author or coauthor of over 280 scientific publications, as well as several books. In particular, he performed groundbreaking studies of the central black hole in the Galactic nucleus, and the astrophysics of magnetoid objects, postulated to exist in the centers of active galaxies.

Dr. Ozernoy began his career in the former Soviet Union during a time of great duress for Jewish scientists. Due to his religious heritage, and his support of fellow dissident Andrei Sakharov, Soviet authorities blocked him from accepting a visiting professorship at Harvard in 1979. As a result of his unsuccessful visa request and resulting status as a refusenik, Dr. Ozernoy was dismissed from his position as Assistant Professor at Moscow Physics & Technology Institute, and was also forbidden from publishing his research. Eventually, through the intervention of United States Senator Edward M. Kennedy, Soviet President Mikhail Gorbachev allowed Dr. Ozernoy to immigrate with his family to the United States in 1986.

In the United States, Dr. Ozernoy held positions as a visiting scientist at Harvard University, Boston University, Los Alamos National Laboratory, and NASA's Goddard Space Flight Center before joining the faculty of George Mason University in 1993. He was promoted to full professor of physics and computational sciences in 2001. During this period of time, he focused his attention mainly on studies of the zodiacal light and the associated problem of the computational dynamics of the solar system. He continued an active schedule of research and teaching at Mason until shortly before his death, and is fondly remembered by his many colleagues, collaborators, and friends. Dr. Ozernoy is survived by wife of 33 years, Maryanne Ozernoy, and daughters Ilana Ozernoy and Alisa Ozernoy Kuperman.

Peter A. Becker
George Mason University

Leonid Ozernoy, 1939–2002
Photo courtesy of George Mason University Department of Physics

**GLADYS TALMAGE PERKIN, 1907–2000**

An ardent supporter of astronomy and AAS Patron, Gladys Frelinghuysen Talmage Perkin, passed away on 28 November 2000. She was the widow of Perkin-Elmer Corporation co-founder, Richard Scott Perkin (1906–1969). Mrs. Perkin was born on 13 May 1907, the daughter of Mr. and Mrs. John Frelinghuysen Talmage of Brooklyn Heights and East Hampton, Long Island, New York. She attended Brooklyn Heights Seminary and Pine Manor in Wellesley, Massachusetts before graduating from Pratt Institute in 1929. Gladys met Richard Perkin in 1927, while still a student at Pratt, but they were not married until 29 April 1930. The marriage resulted in four children.

At the time of their marriage, Richard Perkin was employed by a Wall Street brokerage house though, by 1933, his involvement with the brokerage business had ended. Gladys managed the Perkin household while Richard sought a new source of income. In 1937, Richard was still considering business options when he renewed an acquaintance with Charles Elmer at an international meeting of astronomers at Harvard College Observatory. Together, they founded Perkin-Elmer Corporation with five thousand dollars of Gladys' money matched with the same amount from Elmer's savings. Though originally based on sales of small telescopes into the amateur and recreational markets, the Perkin-Elmer business grew rapidly during World War II with important

Gladys Talmage Perkin, 1907–2000, Patron of the AAS
*Courtesy of James G. Baker*

defense contributions in the manufacture of roof prisms and other optical systems.

While raising her family, Gladys managed to participate in Richard's business-related travel and became well known in the astronomical community in addition to the other components of the Perkin-Elmer business. By the time of Richard's death in 1969 the business was largely in the hands of others, so Gladys devoted her time to the administration of The Perkin Fund endowed by Richard before his death. As chairman of the Perkin Fund trustees, Gladys directed the fund's philanthropy in many directions that reflected Richard's as well as her own interests. As those of us who have served in the leadership of AAVSO as well as AAS can readily testify, astronomy was high on the list of the philanthropic beneficiaries of the Perkin Fund. The largest such gift was for the construction of an astrophysics laboratory at Harvard College Observatory in 1972. The four story addition to the complex nearly doubled the usable space at the observatory. Over the years since then, the Perkin Fund made numerous smaller grants to AAVSO and AAS that facilitated many important programmatic advances in those organizations.

Gladys Perkin is survived by three of her four children, Richard T. Perkin, Winifred Perkin Gray, and Robert S. Perkin, nine grandchildren and two great grandchildren. A third son, John T. Perkin, died in 1997.

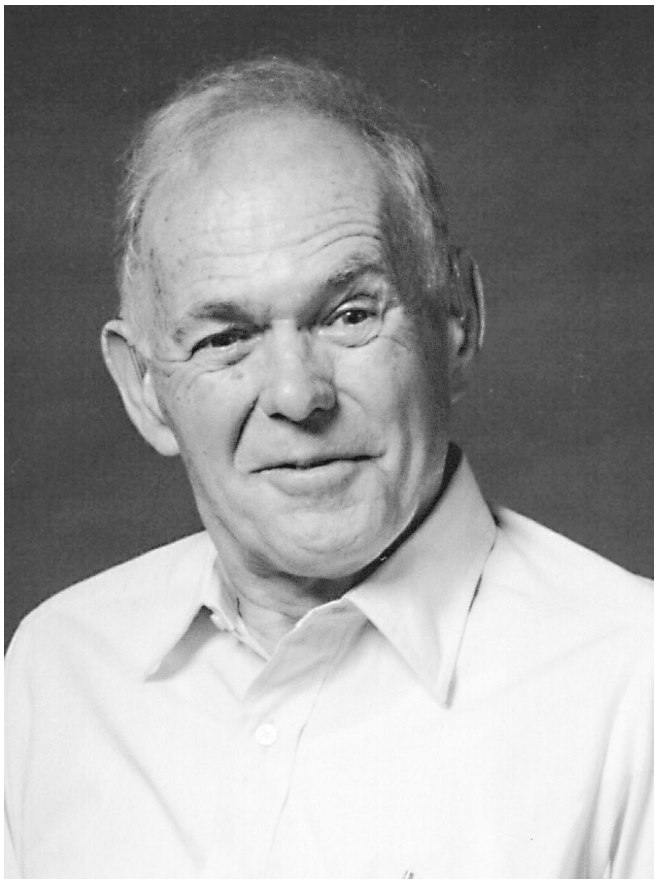
This obituary essay benefited from obituaries published in the *New York Times*, and the Wilton, Connecticut *Bulletin*, as well as from a biography of the late Richard Perkin which had been graciously provided to me by Mrs. Perkin some years ago (Fahy, Thomas P. *Richard Scott Perkin and The Perkin-Elmer Corporation*. Published Privately. 1987. ISBN 0-9618075-0-4)

Thomas R. Williams
Rice University

**JOHN GARDNER PHILLIPS, 1917–2001**

John Gardner Phillips died, after a brief period of failing health, on 1 June 2001. He was an active member of the faculty in the Astronomy Department on the Berkeley campus of the University of California from 1950 until well after his retirement in 1987.

Phillips was born in West Haven (now part of New Haven), Connecticut on 9 January 1917. He was the eldest of four children; he had two brothers and a sister. His father, Ray Edmund Phillips, was a Congregationalist missionary who was assigned to South Africa soon after John was born. John's childhood was spent in Johannesburg where he received his early education. Phillips returned to the United States to attend Carleton College, graduating in 1939, and completing an MS degree in 1942 at the University of Arizona. During World War II, he served as an Instructor of Meteorology at the University of Chicago. After a brief period working in an industrial laboratory, he was accepted in the astrophysics program at the University of Chicago's Yerkes Observatory. Studying the spectroscopy of molecules of astronomical importance with some of the foremost astro-



John Gardner Phillips, 1917–2001
*Photograph by G. Paul Bishop, courtesy of the University of California, Berkeley Department of Astronomy*

physicists of that time, he earned a PhD in Astronomy from the University of Chicago. His 1948 dissertation on the diatomic carbon molecule was based on his research under the direction of Gerhard Herzberg. After two years as an instructor at Yerkes, Phillips joined the Astronomy faculty of the University of California at Berkeley in 1950. In 1960 he was advanced to Professor of Astronomy, and served as Chairman of the Department from 1964 to 1967 and again from 1971 to 1974 before retiring in 1987.

Phillips' scientific contributions were in two main areas, the analysis of the spectra of molecules, and in the design and construction of advanced instrumentation to speed and improve such analyses. He was an early advocate of the importance of computers and made excellent use of them in his work. Phillips published more than 60 scientific papers, many of them in collaboration with Professor Sumner Davis of the Berkeley Physics Department. In addition, Phillips published the bi-monthly *Newsletter of Molecular Analyses* for more than 40 years, first in collaboration with F.A. Jenkins, and later with Sumner Davis. This newsletter, which circulated to several hundred spectroscopists and libraries internationally, reviewed current molecular analyses by spectroscopists worldwide; it continues today under new auspices.

Professor Phillips taught many courses, both specialized astrophysics and general astronomy, in the Department of Astronomy at Berkeley. Over a period of more than 40 years, from shortly after he came to Berkeley until shortly before his death, he taught astronomy to many hundreds of students in a University Extension correspondence course. He strongly believed that such teaching, which took a great deal of time, was an important duty for departments to perform and a very useful service to the students who were frequently far from the University. With Dinsmore Alter and Gerald Clemence, Phillips co-authored a popular astronomy book, *Pictorial Astronomy*, that has gone through many editions.

Through his service on committees, boards, and commissions, Phillips made many contributions to the scientific and academic communities. His advice was frequently sought. In addition to long service as the Treasurer and in other capacities for the Astronomical Society of the Pacific, Phillips was Associate Editor of *Annual Reviews of Astronomy and Astrophysics* from 1966 to 1989, President of Commission 14 of the International Astronomical Union (Atomic and Molecular Data), Representative of the International Astronomical Union on the Triple Commission for Spectroscopy (composed of three International organizations), Member of the Advisory Panel of the National Bureau of Standards (Heat Division), and many others. As a Professor, he was a member of many University Committees ranging from the Physical Sciences Advisory Council to the Astronomy Representative at the School of Education.

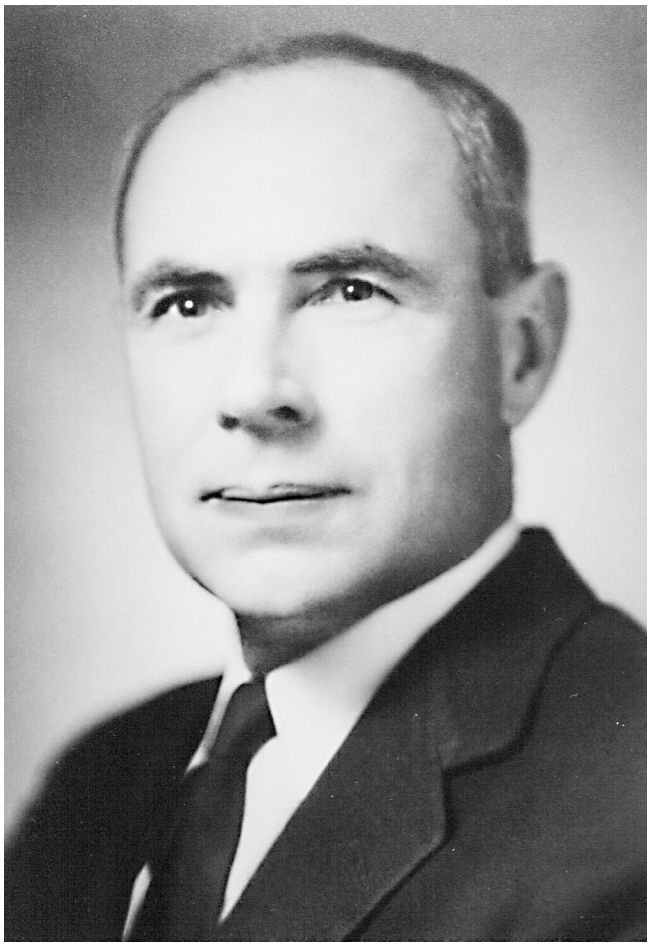
John Phillips is survived by his three daughters, Jane Phillips of El Cerrito, California, Cindy Hart of Edmonds, Washington, and Gail Phillips of Berkeley, California, and by his granddaughter, Diana Hart of Edmonds, Washington. His wife of 55 years, Margaret Butler Phillips, predeceased him by eighteen months. His many friends, colleagues, and former students will always remember his gentle humor, kind advice, and quiet dedication with appreciation and fond regret.

Harold Weaver
Frank Shu
Jonathan Arons
University of California at Berkeley

## ERVIN JOSEPH PROUSE, 1905–1998

Ervin J. Prouse, Professor Emeritus, The University of Texas at Austin, died on 16 June 1998 in Amarillo, Texas. He was ninety-two years old. Born in Anthony, Kansas, on 20 July 1905, Prouse became enamored by the night sky visible from that flat, dark countryside. His future commitment to the study of astronomy was sealed by his sight of Halley's Comet in 1910. He saved pennies from trapping muskrat in the winter and selling ears of corn in Anthony in the summer to purchase science and history books.

Prouse graduated as valedictorian of his class at Anthony High School, receiving a scholarship to attend the University of Wichita. Two years later he transferred to the University of Kansas in Lawrence, where he received his BA in 1927 and MA in 1933. Prouse taught at Washburn College, Topeka, Kansas for seven years, between 1929 and 1937, with an intervening year for graduate work at the University of California at Berkeley (UCB) in 1933–1934. He continued



Erwin J. Prouse, 1905–1998
*Photo by Walter Barnes Studio, Austin, TX., courtesy of Darlene Birkes and Ruth Morgan*

his graduate work in 1937, and earned a PhD in Astronomy from UCB in 1939. Joining the faculty at the University of Texas at Austin (UTA) in 1939, Prouse taught undergraduate and graduate courses in astronomy, mathematics, and physics there from that year until 1972. His research interests were celestial mechanics and the orbits of stars, planets, and satellites.

During World War II, Prouse taught celestial navigation, practical astronomy and general astronomy to Navy cadets. Later, driving from Austin to Houston every Tuesday from 1962 through 1966, he taught the same subjects to three classes of astronauts, the future crews for the Mercury, Gemini, and Apollo flights. NASA was extremely pleased with his work with the astronauts.

In a lifetime of dedication to the study of astronomical science, Ervin Prouse was also devoted to teaching and to his students, many of whom continued to maintain contact with him after his retirement. He was so effective as a teacher that one of the UTA Engineering departments insisted on supplementing his salary for teaching an especially needed mathematics course for their majors (a very unusual movement of money across colleges).

Prouse arrived in Austin in 1939, the same year that the McDonald Observatory was dedicated and formally opened on Mt. Locke at Fort Davis, Texas. The observatory was the result of a cooperative agreement between UTA and the Yerkes Observatory of the University of Chicago. After one of Prouse's month-long stays at McDonald Observatory, in February 1949, he returned to the Austin campus with his recommendations for improvements at the Observatory. At the time, McDonald Observatory had over 10,000 visitors per year, in spite of its remote location in West Texas. Sir Spencer Jones, Astronomer Royal of Great Britain, had been a guest at McDonald during that month. Yet on his return to the Austin campus, Professor Prouse lamented in his notes:

> It seems that the science of astronomy must be sold to The University of Texas. The administration is definitely not interested in this endeavor. When it was suggested that members of the McDonald Observatory participate in some small measure at seminars at the University, President T. S. Painter replied that such seminars required an audience.

After that experience, Professor Prouse devoted a great effort throughout his career to ''selling'' astronomy and, later, the space program. He knew that Texas needed a place to look at the stars scientifically. He was tireless in his devotion to public outreach, through public speaking engagements, viewing hours at observatories, and working with students of all ages. He took part in the Texas Academy of Science visiting scientist program in middle and senior high schools. He continued to accept speaking engagements after he and his wife, whom he married in 1927, moved to a retirement home in Amarillo in 1991. A member of Sigma Xi honorary science fraternity, Sigma Pi Sigma physics honorary society, and a Fellow of the Royal Astronomical Society, London, Prouse was a fifty-year member of the American Astronomical Society, the American Association for the Advancement of Science (Fellow), and the American Association of University Professors. He held membership in the American Mathematical Association and was a Fellow in the Texas Academy of Science.

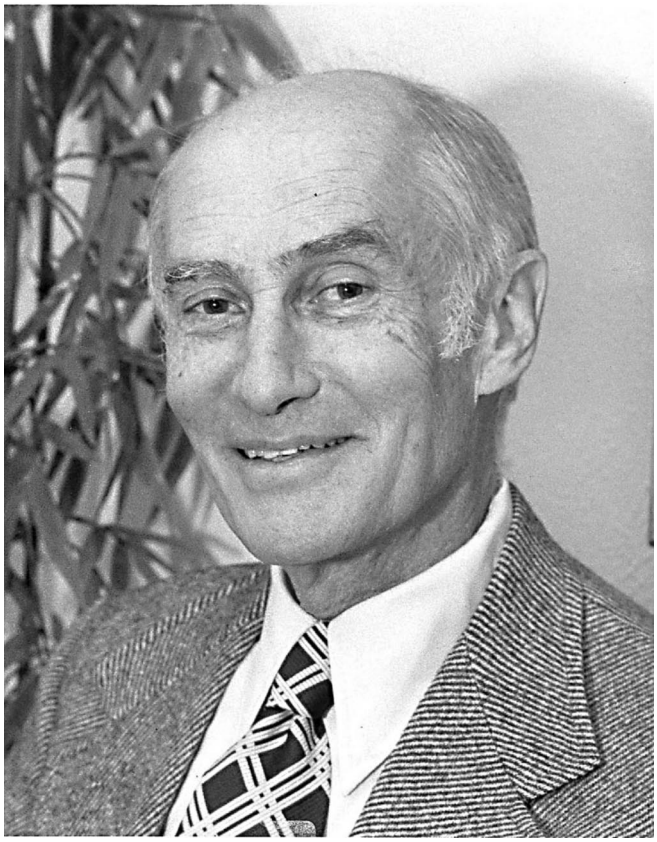
Prouse retired in the Texas Panhandle to be close to the flat land and the open sky that he loved. As a boy, living on a wheat farm in Kansas, he acquired and never lost his love for the wide-open spaces. He farmed wheat land in the summers from 1927 until 1969. His friends and colleagues remember Prouse as quiet, self-effacing, kind, and considerate, and for his utmost honesty and integrity. He was active for over fifty years in University Methodist Church in Austin and was a long-time member of Kiwanis Clubs in Austin and Amarillo. Professor Prouse is survived by three children, five grandchildren and eleven great grandchildren. His wife Thelma followed him in death in 2000 at age ninety-four.

W. T. Guy, Jr.
University of Texas

Ruth P. Morgan
Southern Methodist University

**JOHN A. RUSSELL, 1913–2001**

John Albert Russell, pioneer meteor spectroscopist and founder of the Department of Astronomy at the University of Southern California (USC), died of old age on 2 November 2001. He was 88. Russell was born in Ludington, Michigan on 23 March 1913. Five years later, he and his family settled in southern California. He entered the University of California, Los Angeles (UCLA) as a psychology major but after taking an inspiring elementary survey course in astronomy from Frederick C. Leonard, changed his major to astronomy



John A. Russell, 1913–2001
*Photo courtesy of The Emeritii Center, Univ. Southern California*

the next semester, earning his BA in 1935. In 1937 Russell earned an MA and in 1943 a PhD in astronomy from the University of California, Berkeley (UCB). From 1941 to 1942 he was a Lick Observatory Fellow. He taught at Pasadena City College from 1939 to 1941, and served with the U.S. Air Force from 1942 to 1946. Russell served as Chairman of the Department of Astronomy from his arrival at USC in 1946 until 1969. From 1959 to 1968 he was also Chair, and then Associate Dean, of the Division of Natural Science and Mathematics. Russell retired in 1978.

When Russell came to USC, there was no support for research in astronomy: no equipment and no money. As Ernest Rutherford put it years ago, when you have no money, then you have to think. With a background in meteoritics from Leonard at UCLA, in spectroscopy and statistics from his thesis work with Robert J. Trumpler at UCB, and stimulated by Peter Millman's chapter on meteor photography in *Amateur Telescope Making-Advanced*, Russell chose to observe and analyze meteor spectra. Thus began his nearly half a century of study of the Perseid meteor shower.

One of Russell's earliest spectra provided the first concrete evidence that the spectrum of a meteor depends primarily on the altitude and velocity of the meteoroid and not on its composition. Russell continued his research on meteor spectra, elucidating many fundamental properties not only of the Perseid stream itself but also of the physics and composition of the atmosphere through which those meteoroids traveled. He was an active member of The Meteoritical Society and served as its president from 1958 to 1962.

Russell devoted his efforts equally to research and to undergraduate teaching. Because other southern California universities already had well-developed graduate programs in astronomy, programs which sometimes tended to overshadow the broader and more fundamental astronomy appropriate for undergraduate study, he felt that USC could best make its contribution by providing a quality undergraduate program. Later, in justification of this policy, he was especially pleased and proud of the astronomical accomplishments of USC's astronomical alumni. Russell was one of the very few USC faculty members ever to win both the USC Associates' Award for Excellence in Research and the USC Associates' Award for Teaching Excellence. Russell retired in 1978, but continued to be active in his research almost until he died. He received USC's Distinguished Emeriti Award in 1983.

Of greatest significance is that Russell provided — to his students, colleagues, friends and associates — the finest example of a gentleman and a scholar. It was not merely his broad knowledge of astronomy and pedagogy that set him apart; it was his wisdom: his ability to distinguish right from wrong, in the broadest sense, whether in small day-to-day decisions, or in the determination of long-term policies of the university and scientific societies. Russell had a formal, tolerant, conciliatory nature, and at the same time was always available and helpful to his colleagues and students. He was rarely critical but when critical, was always constructively so. He was a very private person: not many were aware of his off-campus activities. For example, he and his wife exhibited dashing style and ability at Latin ballroom dancing; they were another Fred Astaire and Ginger Rogers.

The writer of this obituary met John Russell in 1946 and had worked with him at USC since 1952. He considers himself supremely fortunate, personally and professionally, to have had for so long such a fine colleague. John leaves a son Stanton James Russell, a daughter Carolyn R. Gold, and his wife Phyllis R. Russell.

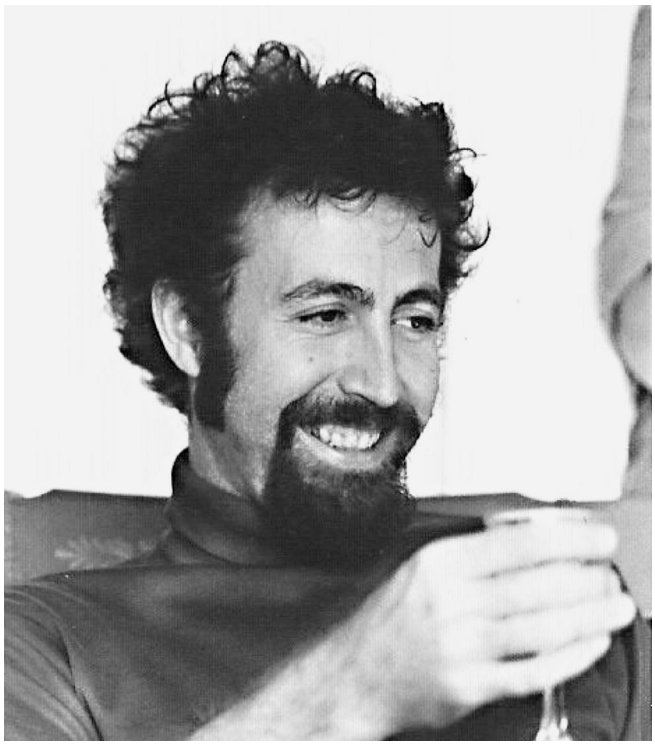
Gibson Reaves
University of Southern California

## ROBERT ANDREW SCHOMMER, 1946–2001

Dr. Robert A. Schommer, a widely recognized expert on stellar populations and on cosmology, died tragically on 12 December 2001, in La Serena, Chile. Since 1990, he had been on the staff at the Cerro Tololo Interamerican Observatory, where he was the equivalent of full professor, and where he had become the Project Scientist for the US Gemini Project Office.

Bob leaves behind his wife Iris Labra, and three children, Paulina, Andrea, and Robert. Bob was born in Chicago on 9 December 1946, to Harvey and Bea Schommer. Bob spent two years in a seminary in Chicago between high school and his physics studies. His scientific education included a BA in Physics (1970) at the University of Chicago, and an MS in Physics at the University of Washington (1972), followed by a transfer to the Washington Astronomy Department and a PhD in 1977.

Bob had many nicknames: ''Bob,'' ''Bobo,'' ''Bobby,'' ''Schommer,'' and ''Dr. Doom.'' The most telling nickname, however, was given to him by the technical staff on Tololo Mountain (most of us do not want to know their nicknames for us): ''Tio Bob,'' which means ''Uncle Bob.''



Robert A. Schommer, 1936–2001
*Photo courtesy of Paul Hodge*

Much scientific collaboration sprang up among the Washington graduate students, whose offices were in a separate building from those of the faculty. Bob and Ron Canterna used the then-new Washington photometric system to explore the clusters of the outer halo of the Milky Way, and came to the conclusion that there was no metallicity gradient in the outer halo. They also found the first carbon star in a dwarf spheroidal galaxy from this broad-band photometry. Bob and I began our study of the stellar content of the Ursa Minor dwarf spheroidal galaxy. He later gave finding charts of giants and carbon star candidates in several dwarf spheroidal galaxies, including Ursa Minor and Leo II, to the late Marc Aaronson (1950-1987), thus allowing Aaronson and Jeremy Mould to observe for their classic survey of the properties of red giants in dwarf spheroidals. Bob and Greg Bothun began collaboration with their advisor, Woody Sullivan, to study the H I content of galaxies in several nearby clusters using Arecibo data. Schommer and Bothun realized that this work had more scientific power when used in concert with the infrared photometry of Aaronson and Mould and John Huchra. The new Arecibo data and new photometry were then exploited in a series of papers that challenged the established size scale of the universe.

Bob went to Caltech in early 1977 as a post-doc on a Chaim Weitzmann fellowship, and began studies of the stellar content of Magellanic Cloud clusters using photographic plates from Las Campa˜nas. He spent a year in Seattle as an instructor, where he taught Galactic Astronomy in the style of his mentor, Paul Hodge. Bob also spent time at Yerkes Observatory, and used a NATO post-doc to work at the Institute for Astronomy in Cambridge, England.

Bob was a professor in the Physics Department at Rutgers University for about a decade after his itinerant post-doc/instructor period, and before his move to CTIO. During this time his science included some of the first CCD-imaging studies of LMC clusters, a paper on what is now called the ''short distance'' to the LMC, a study of the kinematics of the system of LMC clusters, the abundances and age-metallicity relation of those same clusters, and a provocative comment about the mass and extent of the LMC. He also collaborated with Carol Christian on the cluster system of M33 and ultimately showed how different the cluster systems of the Milky Way, the LMC, and M33 were.

Furthermore, Bob teamed up with fellow Rutgers professor Ted Williams to bring the Rutgers Imaging Fabry-Perot to CTIO where it was available to the community for several years.

Bob and George Lake began their studies of the dark matter contents of galaxies in the early 1980s while Lake was at Bell Labs and sharing living quarters with Bob. They derived M/L of galaxies from studies of binary galaxies, and later teamed up with Jacqueline van Gorkom to measure the rotation curve of DDO 170 out to a distance of 7.4 disk scale lengths.

During the 1980s and 1990s Bob's interests in halos of galaxies, masses of galaxies, kinematics of galaxies, and the local and global distance scales continued. After moving to Cerro Tololo he began to be more involved in supernovae and cosmology, starting an incredibly productive decade of research with Nick Suntzeff, Mark Phillips and many others. While the supernova research seems to have taken most of his scientific time (he once calculated that he had only 10% of his time to do science), he was still involved in studies of the cluster and old stellar populations in nearby galaxies, often using HST. His work in the 1990s will be largely remembered for the Tololo-Calan collaboration and the High-Z Supernova Search, which ultimately led to the paper (Riess *et al.*, 1998, AJ, 116, 1009) arguing that we live in an accelerating universe with a cosmological constant.

Bob's collaborations were remarkable for their inclusiveness. There was no team leader, everyone was equal. These collaborations were strengthened because of this attitude, plus they were fun! Bob's colleagues all felt that they were his friends, which of course made daily interactions more enjoyable, and allowed more work to get done. Bob's attitude was that we are all in this together, observatory directors and scientific colleagues and engineers and technicians and support staff. He treated everyone as he expected to be treated. Bob also believed that observers all have to help each other, for telescopes and weather have a way of not quite cooperating, potentially leaving us stranded without that last piece of data. He gave freely of his observing time and of his observing skills.

Bob's inclusiveness, his caring for other observers, his skills as a diplomat and a gadfly and instrument builder, and his excellent training and experience in both physics and astronomy made him a natural choice as head of the US Gemini Project Office. For Bob, the mission was how to get the observers their observations with a minimum of bureaucratic and technological impediments. For many of us, it came as a surprise that he was willing to give up much of his scientific time to undertake what seemed to be this hopeless chore. The countless meetings and telephone conversations did take something significant away from Bob, but from all accounts he was a calming and sensible influence on the US Gemini project.

Bob cared passionately about politics going back at least to his days as an undergrad at Chicago during the Johnson and Nixon Vietnam days. He was a liberal in the true sense of the word, not as it has been co-opted today. He financially supported many causes such as Amnesty International, and was a board member of a small foundation, called the Fantasy Salvage Fund set up in the bequest of his late college friend Harold Seewald, which tried to help causes dear to the hearts of those [mostly] 1960s University of Chicago students: a grant to a Mexican political asylum-seeker to support her while her asylum application was processed; a purchase of computers for Seewald's local public library; a Free Tibet/Tibetan spirituality conference; the Zip-Zap Circus School in South Africa (which trains orphans from all over the world in circus skills for future careers as circus performers); the Harold Seewald Hampshire County Fuel Fund (providing fuel subsidies for low-income people); and a matching grant to the Meekins Massachusetts Library.

Bob believed in helping others. He moved to Tucson twice in the late 1980s to be with me after the tragic death of our collaborator Marc Aaronson. Bob left Rutgers for a while to care for his sister and her children during her serious ill-

ness. Bob brought his nephew Bill to Chile for a year to help resolve some family problems. Bob was also Uncle Bob to children of many friends.

A section of the Cerro Tololo Interamerican Observatory web pages is set aside to present memorial material on Bob Schommer and links there can be followed to a web page that contains many photos that illustrate Bob's active and friend-filled life: http://www.ctio.noao.edu/pers/schommer.html. A longer version of this obituary essay is included there.

There were many other pleasures in having known Bob. He was fanatic about sports and music. Cassettes and emails flowed to many of us. Bob rarely slept completely through the night, so he could be counted on to send email at all hours to help his observing friends survive. Observing nights are much longer without Bob.

Edward W. Olszewski
Steward Observatory, University of Arizona

**JULIAN J. SCHREUR, 1939–2001**

Julian Jay Schreur, an associate professor of physics and astronomy at Texas A&M University-Kingsville (TA-MUK), died of complications associated with a liver transplant on 3 November 2001 in Houston, Texas.

Jay was born in Kalamazoo, Michigan on 19 January 1939 to Neal and Wilma Schreur. After graduating from high school, he attended Kalamazoo College, where he earned a Bachelor of Science in Physics in 1961. He then spent a year at the University of Bonn studying German and astronomy. Upon returning to the United States, he attended the University of Arizona, earning his PhD in Astronomy in 1970 studying under Dr. Bart Bok. During his graduate days in Tucson, Jay met and married math/physics graduate student Barbara Fischer in June 1966. She became a graduate assistant to Elizabeth Roemer the following year. Barbara later earned a PhD in Mathematics at Florida State University and is an AAS member.

In 1970 Jay joined the faculty at Valdosta State College (now Valdosta State University), which, at the time, did not have an astronomy program. Working with Dennis Marks, Jay developed the Bachelor of Science in Astronomy program that was approved in 1973. Today it is still the only undergraduate major in astronomy in the Georgia State University system. From 1970 to 1973, Jay served as the first director of the observatory and planetarium at Valdosta. He became the department head in 1973, holding that position until he left VSU. In the mid-1970s, Jay contracted autoimmune hepatitis and suffered from that affliction for the remainder of his life.

When Jay's wife, Barbara, received an offer of a tenure-track position at Texas A&M University-Kingsville (then Texas A&I University) in 1980, Jay moved to South Texas. He worked for TRW in Corpus Christi from 1980 until 1985, when he began working as a part-time instructor at Texas A&I. In 1987, the Schreurs spent a year in Malaysia where Jay taught physics as part of the Texas International Education Consortium. Upon returning to Kingsville, Jay taught part time in the Physics Department as an associate professor. In 1997 he was hired full time, remaining with the department until he retired in 2001.

Julian J. Schreur, 1939–2001
*Photo by Olan Mills, courtesy of Barbara Schreur*

During the years that he worked in astronomy, Jay made numerous important contributions. Even though his dissertation was on Stellar Distributions at High Galactic Latitudes, Jay's first love was instrumentation development. While at Valdosta State College, he equipped and commissioned their first telescope. Jay also designed a spectrograph that is still in use there and at other schools. After coming to Kingsville, he assumed responsibility for maintaining our 16-inch telescope. In 1995, he received a NSF-ILI grant to upgrade the mechanical, electrical and instrumentation support on the telescope in order to bring it up to research quality. Today this telescope is used to support faculty and undergraduate research projects.

Jay's interest and expertise extended beyond small telescopes however. During the summers of 1996 and 1999, he worked at NASA's Marshall Space Flight Center on the development of the Next Generation Space Telescope (NGST). He studied the effects of misalignment and surface dust on the image produced by the segmented mirror. The results from Jay's study were critical to reducing the costs associated with the NGST. He proved that surface dust produces negligible scattering intensities, thus eliminating the need for an ultra-clean room during NGST mirror assembly.

Jay's impact went beyond those associated with astronomical instrumentation. He was also an excellent teacher who affected the lives of many students. He developed a class for students to learn how to design planetarium shows while at Valdosta. This class has been instrumental in train-

ing many planetarium directors across the country. At Texas A&M-Kingsville, Jay worked with the Electrical Engineering and Computer Science department, guiding senior research projects involving telescope upgrades. He was extremely active in public outreach, often hosting astronomy programs both on campus and off. Jay was always willing to tackle new courses, teaching classes in the physics of sound, optics, and classical mechanics (to name a few) in addition to his astronomy courses. He remained one of the department's more popular teachers, and students actively sought his classes.

Outside the classroom, Jay was an avid golfer. If the weather permitted, he would often shoot at least one round a week. Whenever possible he would take along a student, fellow faculty member, or his wife. Jay was also an accomplished gardener. Rose cuttings from his garden frequently brightened the departmental office at TAMUK. Jay was one of the founding members of the university's ''Coffee Klatch,'' and could be found every morning in the TAMUK Student Union, exchanging news with other faculty members from across the University.

Jay's impact on everyone he met was always a strong and lasting one. He will be remembered not only for his outstanding professional qualities, but also for his upbeat personality, his keen insights, his eagerness to help any student, and the love that he felt for his wife and sons. His death came as a shock to everyone who knew him, and his loss has been keenly felt. Jay is survived by his wife Barbara, and their sons Alex and George. A third son, Stephen, died of cancer in 1988.

Daniel Suson
Texas A&M University-Kingsville

**PHILIP EDWARD SEIDEN, 1934–2001**

Philip Edward Seiden died on 21 April 2001 from congestive heart failure that followed an intensive treatment for cancer in the 1980s. He joined our astronomical community when he was 44, after a successful career as a solid state physicist and IBM manager. He worked on galactic structure from 1978 to 1989 and on the structure of sunspot groups from 1992 to 1996.

Philip was born in Troy, New York, on 25 December 1934, to Herman and Freida Seiden. They moved to Chicago when Philip was three. His father was an electrical engineer and inventor, holding many patents including one for the payout device in slot machines manufactured by Bally Corporation, where he was director of research and development. Philip received his MS in 1956 from the University of Chicago and PhD in Physics in 1960 at Stanford, where he worked on magnetic resonance in yttrium iron garnets under John Shaw. After joining the Research Division of IBM in 1960, he worked on magnetism, superconductivity, and organic solids, becoming the first person to receive a patent in the new field of molecular electronics in 1974. He rose through management ranks quickly, becoming director of the physical sciences department in 1972 and director of general sciences in 1976.

During this period Philip spent a year at the Technion in Haifa, Israel where he collaborated with Lawrence Schulman on cellular automaton studies of Conway's Game of Life, producing a publication in 1978 on phase transitions and the relevant thermodynamics. When an astronomy post-doc in his department, Humberto Gerola, noted the resemblance between propagating star formation and the spreading patterns in cellular automata, Philip resigned his management position to work with Humberto on galaxies. They considered the on and off bits of a cellular automaton in a circular shearing grid to represent active and inactive sites of star formation, and showed how numerous local events can combine over time to produce long and persistent spiral arms. This idea progressed for another six years, leading the two of them, along with Schulman (now at Clarkson University in Potsdam, New York), to propose explanations for galactic Hubble type exponential disks, and star formation rates. Philip's interactions with Debra Meloy Elmegreen, who followed Humberto as an IBM post-doc, led to the development of spiral arm classes.

Philip immersed himself completely in these models, inviting other astronomers to IBM for conferences or visits, attending international meetings, and giving talks around the country. He was the first to model star formation in holistic terms, introducing feedback and chaos to whole galactic gas systems, discussing percolation and phase transitions—useful concepts from his physics heritage—and using the results to explain disk evolution. Perhaps Philip's most influential papers focus on the large-scale variability of star formation in dwarf galaxies, a concept which he introduced in 1980 long before dwarfs were as fashionable as they are today. Movies of his propagating star formation models ran at the Smithsonian National Air and Space Museum for

Philip E. Seiden, 1934–2001
*Photo courtesy of IBM, Inc.*

many years, illustrating to the public how percolation theory can be applied to galactic star formation.

From the beginning of this research on galactic structures, Philip recognized the importance of data visualization, and built a world-class system at IBM for the processing of galactic images. This included a scanning microdensitometer for photographic plates taken by Dr. Debra Elmegreen at the Mt. Palomar telescopes, new image processing software that was available at IBM long before the advent of personal computers, and an office-size color printing machine that made slides from digitized images. Philip's goal was to enhance galaxy images, pulling out details about star formation and density waves that could not be seen on normal photographs. His first results came in 1982 when he published two-dimensional Fourier transform images of whole galaxies. Among his most important contributions was a paper written in 1989 with Bruce and Debra Elmegreen using symmetry properties of near-infrared images to prove the existence of spiral wave modes that had been predicted by C. C. Lin and his group at MIT.

In 1992, Philip published his first of two papers on solar active regions with Donat Wentzel of the University of Maryland. The models were similar to those used for galactic structure in that they involved cellular automata and percolation, but this time what percolated was magnetic flux. The model again simplified a very complex system, but even so, Philip obtained realistic size and age distributions for sunspots.

Midway through Philip's life as an astronomer, he met Dr. Franco Celada, a professor of Immunology at the University of Genoa, Italy, working at the Hospital for Joint Diseases, New York University. Philip believed that his knowledge of physics, phase transitions, percolation theory and the application of computer modeling would be very useful in this field. In 1992, they produced a computer model that uses cellular automata to simulate the immune system. The model mimics the random encounters and stimulated interactions among various parts of the immune system that are exposed to antigens. It was one of the first models that could run biological experiments, and eventually formed the basis of a corporation that Philip started, called IMMSIM, an acronym for Immune Simulation. The IMMSIM model, for example, can predict the efficiency of a vaccine. As a result, biomedical researchers from around the world sent Philip their theories about potential vaccines for ''in machina'' testing (as opposed to the usual ''in vivo'' and ''in vitro'' tests). Philip was happy to think that IMMSIM probably saved the lives of thousands of mice.

Philip continued his research in immunology after retiring from IBM in 1997, both as a consultant to the Hospital for Joint Diseases and as an adjunct faculty member at Princeton University. One of IMMSIM's most important results during this time was an illustration of the way in which cell-based and antibody-based responses of the immune system combine and sometimes compete to offer the most effective defense. IMMSIM sometimes found that the immune system failed because of this competition, leading Philip and his collaborators at Princeton to understand autoimmunity in a novel way, which they called competitive tolerance. Philip became a popular teacher at Princeton, using IMMSIM to illustrate how the immune system works in both a graduate course and a freshman seminar. His courses were consistently rated the best his students ever had.

Philip Seiden had three fulfilling and productive careers. He used his vast knowledge of physics and unusual intellectual capacity to understand and drive forward a new field of research every decade. He was dynamic, outgoing, and eclectic, enjoying travel, linguistics, gastronomy, sailing, and intellectual debate on a seemingly endless list of topics. He married his high school sweetheart, Lois. After they moved to New York, Lois began a successful career in real estate, a business also followed by their son Mark. Lois lives in Briarcliff Manor, NY, while Mark, his wife Amy and their three children live in nearby Ossining. Philip and Lois' second son, Jeffrey, lives in Vermont.

Bruce Elmegreen
IBM T. J. Watson Research Center

**REIN SILBERBERG, 1932–2001**

Rein Silberberg, an internationally recognized authority in cosmic ray and astrophysics research, died of cancer on 31 August 2001 in Silver Spring, Maryland. He was widely admired among his colleagues for his research on the origin and propagation of cosmic rays. He retired from the Naval Research Laboratory (NRL) in Washington, DC in 1990, where he spent virtually his entire scientific career. He continued an active role in cosmic ray research and high energy astrophysics until his death.

Rein was born in Tallinn, Estonia, on 15 January 1932, the son of native Estonian's Juri and Elizabeth Silberberg.

Rein Silberber, 1932–2001
*Photo courtesy of Ene Silberberg*

His father was a director and co-owner of a maritime shipping company in Estonia. During and in the aftermath of World War II, the family migrated to Finland, then to Sweden, then to New Brunswick, Canada, and finally arrived in the United States in 1950. Attending school in each of those countries Rein became fluent in their languages and developed a lifelong interest in linguistics Rein pursued both undergraduate and graduate studies at the Berkeley campus of the University of California. For his graduate thesis research, he joined the group of Nobel Laureate Emilio Segré. He received his MA in Physics in 1956 and his PhD in Physics in 1960. Guided by Gerson Goldhaber, he studied the interactions of the recently discovered antiprotons, using nuclear emulsions for detection.

In 1960, Rein joined the Laboratory for Cosmic Ray Physics (LCRP) at NRL as a National Research Council post-doctoral research associate. The LCRP, established in 1949 by one of us (Shapiro), had developed advanced techniques for processing stacks of thick photographic emulsions. The LCRP included a well-equipped microscopy laboratory for the analysis of particle tracks in nuclear emulsions, useful tools in the investigation of problems in elementary particle physics and cosmic rays. In the early 1960s, Rein and his colleagues continued to investigate the composition of cosmic rays using stacks of thick photographic emulsions flown on high altitude balloons. They established the relative abundances of $^{3}$He and $^{4}$He in the primary cosmic radiation and subsequently confirmed the value of the mean-free-path of galactic cosmic rays. A prior experiment by the NRL group had determined the relative abundance of the elements lithium, beryllium, and boron among the primary cosmic rays. Those observations had revealed that the ''primary'' cosmic-ray nuclei must include a substantial component of secondary cosmic rays, which are, in turn, fragmentation products resulting from collisions of parent nuclei in the tenuous gas of the interstellar medium. From the ratio of some secondaries observed to the primary target nuclei, the mean free path of the cosmic rays in the interstellar medium and their residence time in the Galaxy was also deduced. The presence of secondary particles from collisions of primary cosmic rays with gases in the interstellar medium also provided the opportunity to investigate the question: What do the cosmic rays look like when they are first accelerated? The NRL team (Shapiro, Silberberg and Tsao) embarked on a program to investigate the source composition of cosmic rays. This composition, in turn, provides the principal clues to the origin and acceleration history of the high-energy particles.

Execution of the program on the propagation and transformation of cosmic ray in the interstellar medium required that reaction cross sections for the breakup of relativistic heavy nuclei into lighter ones be developed. No theoretical, and very few experimental, values of these cross sections were available. The NRL team envisioned the need for calculating the yields of all the collision cross sections (elemental and isotopic) for all the cosmic ray ions (from lithium to uranium) and over a broad range of energies. In 1967, guided by the only available measured cross sections (at best a handful), Rein developed a set of semi-empirical equations for deducing the needed cross sections. Over the years, he and one of us (Tsao) collaborated to steadily revise and improve those equations using new measurements from accelerators. The Silberberg-Tsao equations have become an essential and widely used tool for elucidating the source composition and propagation of cosmic rays. Rein was also among the pioneers who showed the importance of cosmic-ray reacceleration.

Throughout his career, Rein also contributed to the science of radiation effects. His concerns included the biological effects of cosmic rays and other radiation, energy deposition by nuclear interactions, and the formulation of radiation protection requirements for space environments, specifically for a lunar base and for manned missions to Mars. The Silberberg-Tsao semi-empirical equations have been also used in developing optimum shielding against cosmic-ray radiation and also in radiation therapy, where heavy ions are used, by calculating the energy deposition rate from nuclear interactions. His work on radiation effects also found applications in the computer industry and the defense community.

Theoretical neutrino astronomy was also an interest, and on that basis Rein participated in Project DUMAND (Deep Underwater Muon And Neutrino Detection). Collaborating with one of us (Shapiro) in Project DUMAND, he calculated the prospects of identifying promising celestial sources of high-energy neutrinos.

Rein was a Fellow of the American Physical Society. He authored or co-authored over 200 peer-reviewed papers in the scientific literature. After his retirement from NRL he continued cosmic-ray research with scientists at NRL and Roanoke College in Salem, Virginia.

Rein suffered from a form of ataxia, a progressive neurological disorder, and otosclerosis, but continued his highly productive scientific research in spite of these difficulties. He was selected as the Navy's Outstanding Handicapped Employee of the year in 1983. By sheer resolve, Rein did not let his physical handicaps impede his productivity. He served for many years as Associate Director and lecturer in the International School of Cosmic-Ray Astrophysics at the Majorana Center in Erice, Italy. Rein was an active member of the Estonian community in the Washington, DC area, and relished several opportunities to visit his homeland. He also served as science editor for the Estonian language cultural periodical ''Mana.''

Rein was generous and considerate to a fault. Despite this single-minded dedication to research, he always found time to help friends and especially younger scientists. We are fortunate that he was our friend and collaborator. In 1965, on one of his frequent visits to friends in Canada, Rein met and married pharmacist Ene Rammul, also a native Estonian, who fled to Canada with her family just before the Russian invasion of their homeland in 1944. Ene, their son Hugo, daughter Ingrid, son-in-law Kevin and granddaughter Kristy, survive and fondly remember Rein.

James D. Kurfess
Naval Research Laboratory

Maurice M. Shapiro
University of Maryland, College Park

Chen Hsiang Tsao
Roanoke College, Salem, Virginia

## LEE WILL SIMON, 1940–2000

Lee Will Simon, an astronomer by education, and a planetarium administrator by profession, was born on 18 February 1940 in Evanston, Illinois. He was the son of Clarence T. Simon, a professor of speech pathology at Northwestern University, and Dorothy (née Will) Simon, a homemaker, drama coach and published poet. Simon earned a Bachelor's degree in Mathematics (1962), a Master's degree in Astronomy (1964), and a Doctorate in Astronomy (1972), all from Northwestern University. His doctoral dissertation was on the spectroscopy of long-period variable stars.

In 1969, Simon joined the Astronomy Department at the Adler Planetarium in Chicago where he led the exhibit development and sky show production efforts. Although he was a consummate lecturer, Simon gradually converted the staff from live to taped sky shows in the mid-1970s. He was the Adler's Program Supervisor for nearly ten years before being appointed Morrison Planetarium director at the California Academy of Sciences in San Francisco.

Simon arrived at Morrison Planetarium in January of 1977 and immediately set about making changes. He succeeded Captain Robert Risser, who had led the planetarium for ten years and had established a substantial improvement fund. This fund allowed for some major upgrades to the planetarium theater, including a renovation of seats and carpeting and a modernization of the theater's electronic controls. Simon formalized the planetarium's production procedures and reinstated the planetarium's Artist position. He was the first PhD to head the Morrison Planetarium and was active in the Academy's Curator's Forum, serving as one of its first chairpersons. Simon was widely known as a lecturer with the ability to bring an understanding of astronomy to the layman and was an invited lecturer on total eclipse expeditions in Mexico, Russia, and Indonesia.

In the fall of 1981, Dr. Simon solicited reports from eight individuals, staff members and outside consultants, to help him determine the future direction for Morrison Planetarium. These reports proved to be invaluable as a basis for changes that would be made during the next ten years. Unfortunately, in February 1982 Simon suffered a stroke while he was on a family ski trip. He returned to work after recuperating for several months but was unable to resume his administrative duties. Simon was then appointed Staff Astronomer and served in that capacity for more than a year. His counsel during this time was very valuable in determining the planetarium's long-range plans. Simon retired from the planetarium in 1984.

For the next sixteen years, Simon involved himself in community service, mostly in California's Marin County, where he resided. He was active in Indian Guides, Cub Scouts, and Boy Scouts in Marin County. He was also an enthusiastic fundraiser for the Marin YMCA. He was a founding member of the Stroke Association of Marin and actively participated in classes at the Disabled Student Program at the College of Marin. He was a member of the St. Vincent de Paul Society at Our Lady of Loretto Church.

Lee W. Simon, 1940–2000
*Photo by Lloyd Ulberg, courtesy of the Califonia Academy of Sciences*

Simon died of leukemia on 18 January 2000. He is survived by Mary Jo, his wife of 34 years, and three sons: Daniel of Novato, California; Stephen of Los Angeles, California; and John with wife Jennifer and children Kaylee and James of Seattle, Washington.

Steven B. Craig
Morrison Planetarium, San Francisco

## ALEXANDER GOUDY SMITH II, 1919–2001

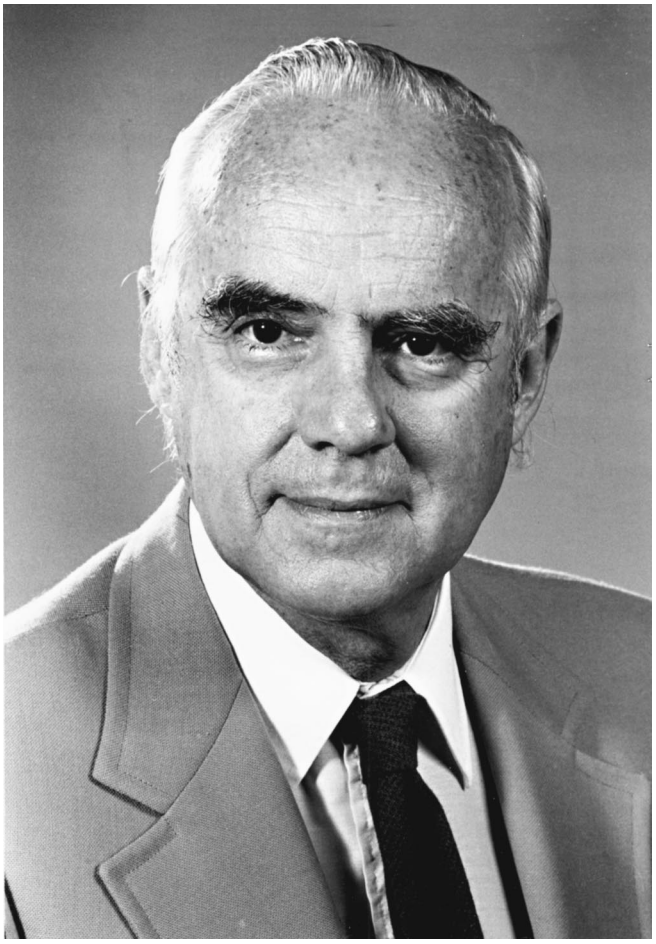
Distinguished Service Professor Alex G. Smith joined the faculty of the University of Florida (UF) in 1948. By the time he retired as a full time professor in 1998 he had completed 50 years of service to the University. Smith was responsible for the initiation and development of the entire University of Florida astronomy program, both teaching and research, which resulted in our current status as a nationally ranked department of astronomy.

Smith was born on 12 August 1919 in Clarksburg, West Virginia to Helen Eleanor (née Reitz), a homemaker, and Edgel Orr Smith, a coal mining safety inspection engineer. Alex Smith received his SB in Applied Physics from the Massachusetts Institute of Technology (MIT) in 1943, and was a member of the staff of the MIT Radiation Lab from 1942 to 1946. Smith received his PhD in Physics from Duke

University in 1948. His dissertation research was in the area of microwave spectroscopy.

Becoming involved in astronomical activities shortly after his arrival on campus in 1948, Smith and another member of the faculty obtained funding by 1951 for the University of Florida's planetarium projector, a Spitz Model-A. The funds available did not extend to the purchase of a projection surface, so Smith constructed the sixteen-foot dome himself. While still in the Department of Physics, by 1952 Smith had begun the publication of papers on astronomical observations and atmospheric optics.

The arrival of Thomas D. Carr (now Professor Emeritus) as a graduate student initiated a collaboration on radio astronomy that would last for many decades. Smith and Carr established the first UF radio observatory in 1956. Based on their work at this observatory and its successors including a site at Maipu, Chile, Smith and his students published more than thirty papers on radio astronomy. By 1962, Smith had supervised five of the total of nineteen PhDs granted by the Department of Physics, four of these in the areas of astronomy or atmospheric optics. An additional five candidates received their PhDs under the supervision of Smith and Carr within the next three years. This productivity in the area of astronomy led to the renaming of the department as the Department of Physics and Astronomy in 1962. Appointed Chairman for Astronomy, Smith held that position from 1962 to 1971. In 1970, the department received the right to grant a PhD in Astronomy (in addition to the PhD in Physics). By 1970 Professor Smith and his students who joined the faculty after their own graduation had already supervised fifteen of the total of eighty-six PhDs granted by the department.



Alexander G. Smith, 1919–2001
*Photo courtesy of Sally Geil*

During this time Smith was the primary author of an NSF ''Center of Excellence'' proposal that brought more than one million dollars to the department. The astronomy portion of this grant included the establishment of the Rosemary Hill Observatory (including its 30 inch research telescope), and expansion of the new Dixie County Radio Observatory. The internationally recognized Active Galactic Nuclei (AGN) observational program carried out by Smith and his students at Rosemary Hill resulted in 45 papers and eight book chapters on AGN and related objects. Their efforts established Florida as a preeminent AGN monitoring site.

In another area, Smith's program of photographic photometry led to more than twenty papers and seven book chapters on photographic emulsions and techniques. These publications discussed numerous innovations including hyper-sensitization of astronomical emulsions. Smith served from 1975 to 1987 as the editor of the *AAS Photo Bulletin.*

A few years after the NSF grant, Smith was again a major participant in writing a proposal of significance to UF, this time a proposal to NASA. The result was construction of the Bryant Space Science Center that now houses the Department of Astronomy.

During his more than fifty years at UF, Smith served in many other posts and received many honors. He served as a director for the Association of Universities for Research in Astronomy from 1960 to 1963; Acting Director of the Cerro Tololo Inter-American Observatory in 1966; Acting Dean of the UF Graduate School from 1971 to 1973; and as UF representative on the Southeastern Universities Research Association Board of Trustees from 1982 to 1991. He also served on the Space Sciences Panel of the National Research Council's Postdoctoral Research Associateship Program from 1982 to 2001. Smith held the rank of UF Distinguished Service Professor each year from 1982 to 1998. His faculty appointment was as both Professor of Physics and Professor of Astronomy. Smith finally retired from the University of Florida in May 2001. Up to that time, he continued an active research program, including several nights each month at the Rosemary Hill Observatory. He led the effort to design a new teaching observatory and outreach center planned for an isolated spot on campus, and continued to teach at both the undergraduate and graduate level. His most recent teaching achievements included an outstanding teaching award in 1994 and the complete development of a new undergraduate ''hands-on'' astronomy laboratory course.

Smith was an outstanding member of the university faculty with a record of distinction and dedication to astronomical research, teaching and administration that very few will ever equal. He will be deeply missed.

Smith is survived by his wife Mary (née Ellsworth) Smith whom he married in 1942, a son, Alex G. Smith III, and daughter, Sally Geil.

Stanley F. Dermott
John P. Oliver
University of Florida

**THOMAS J. SODROSKI, 1958–2002**

It is with profound sadness that we announce the untimely death on 22 February 2002, of our dear friend and colleague, Dr. Thomas J. Sodroski, the son of Walter and Catherine Sodroski. At the time of his death Tom was working with his colleague Dr. Nils Odegard, at NASA Goddard Space Flight Center, developing models for the origin of the diffuse Galactic gamma-ray emission from the Milky Way, and providing scientific support for the archiving and dissemination of astronomical data at the National Space Science Data Center (NSSDC).

Tom was born on 10 September 1958 in the coal-mining town of Summit Hill, Pennsylvania. The setting of the small town provided an ideal backdrop for Tom's youthful imagination. The youngest of three boys, Tom showed an early affinity for astronomy, spending many clear nights in the backyard with telescopes. Tom's interest in astronomy led him to rocketry, starting initially with crude space capsules, which later evolved with the help of local machinists, teachers and craftsman into quite sophisticated solid- and liquid-fuel rockets.

After his graduation from Marian High School in Hometown, Pennsylvania, Tom obtained his undergraduate degree from Lehigh University. He spent a post-graduate year at the University of Pennsylvania, where he met Biya, his future wife. Tom then moved to College Park where he pursued his life long passion in the Astronomy Department of the University of Maryland. He received his PhD degree in 1988 under the supervision of the late Professor Frank Kerr who pioneered the largest atomic hydrogen survey of the Milky Way, and Dr. Michael G. Hauser, then a member of the Infrared Astronomical Satellite (IRAS) Science Team. For his thesis, Tom pioneered the application of numerical inversion techniques to radio and infrared surveys of our Galaxy in order to infer the three dimensional structure of its interstellar medium (ISM). Tom developed a model for the large-scale distribution of interstellar dust in the Galaxy, and its association with the molecular, atomic, and ionized phases of the ISM. During the period of his dissertation Tom demonstrated outstanding abilities as a scientist especially in his analysis and interpretation of observational data. For his thesis he wrote the first major and still the best papers on the distribution of interstellar gas in the ISM using the IRAS data.

Following his PhD, Tom was awarded a National Research Council (NRC) Resident Research Associateship at the Infrared Astrophysics Branch at NASA Goddard Space Flight Center. At that time, a major issue in galactic studies was the amount of molecular hydrogen present in the ISM. Its abundance is inferred from the presence of another molecule, CO, and depends on the factor used to convert from CO to molecular H abundance. Astronomers usually adopted a single numerical value for the conversion ratio throughout the Galaxy. However, Tom's studies on this topic showed that this ratio varies within the Galaxy. He derived its numerical value as a function of Galactocentric radius, quite a revolutionary discovery at that time.

After completing his NRC Fellowship, Tom joined the team of scientists entrusted with the analysis of data obtained from the Diffuse Infrared Background Experiment (DIRBE) instrument on board the Cosmic Background Explorer (COBE) satellite. During this period, Tom was assisting in the search for the diffuse infrared background, and was a lead investigator on some of the important scientific publications made possible by the DIRBE data. In 1997, using this data, he presented a three-dimensional model for the infrared emission from the Milky Way, depicting the contribution of each of the different gas phases of the ISM to the large-scale emission from our galaxy. His work on the subject is widely cited, and to date unsurpassed in scope and quality.

Tom Sodroski, 1958–2002
*Photo courtesy of Eli Dwek*

During his graduate studies Tom acquired (out of necessity) an intimate knowledge of the inner workings of car engines, which he used to help fellow students repair and maintain their cars. He also loved to scout the antique markets for bargains, and restored antique furniture as a hobby. Tom was an avid lover of the outdoors, constantly exploring the web of biking and hiking trails in the area around Washington DC, exploring Civil war battle sites, spelunking, and sailing the waters of the Chesapeake Bay.

Tom had a healthy sense of humor and a circle of close friends who could always rely on his assistance. He will be greatly missed by all his friends and colleagues. Tom was laid to rest on 1 March 2002 in his home town in Summit Hill. He is survived by his mother, brothers Joseph and Tony, and Biya and son Jake.

Rick Arendt, Eli Dwek, Ron Ghosh, Mike Hauser, Tilak Hewagama, Louis C. Kouvaris, and Nils Odegard
NASA Goddard Space Flight Center

## CHARLES BRUCE STEPHENSON, 1929–2001

Charles Bruce Stephenson, the Worcester R. and Cornelia B. Warner Professor Emeritus of Astronomy at Case Western Reserve University, died in his sleep at home on the morning of 3 December 2001, at the age of 72. The only son of Chauncy Elvira and Ona (née Richards) Stephenson, Bruce was born in Little Rock, Arkansas on 9 February 1929. Raised on a farm in Illinois, Chauncy served in the US Army A. E. F. Ordnance in WWI, studied fire prevention at the Armour Institute (now Illinois Institute of Technology) and worked in the Fire Prevention Bureau of the State of Arkansas until his retirement. Ona was raised on a farm in Arkansas, and for many years worked as a secretary for an insurance company.

From an early age, Bruce was a gifted student and independent thinker. He received the Bausch & Lomb Science Award in high school. He made his own telescope, and was an active avocational observer throughout his life. The first entry in his personal observing log was dated October 1943, the last, November 2001. Bruce served as Mercury Recorder for the Association of Lunar and Planetary Observers during the years 1949 and 1950. After attending Little Rock Junior College, he transferred to the University of Chicago, where he earned a BS (Mathematics) and an MS (Astronomy) in 1949 and 1951 respectively. His master's thesis on the light curve and color of Vesta was supervised by Gerard P. Kuiper. From 1951 to 1953 Bruce worked for Kaj Aa. Strand as a Research Assistant in Astronomy at the Dearborn Observatory of Northwestern University. He then served in the US Army Map Service Lunar Occultation Program under the direction of John O'Keefe from 1953 to 1955.

Following his discharge, Bruce continued his graduate studies at the University of California, Berkeley, where he was a Teaching Assistant 1956–57, a Lick Observatory Fellow 1957–58, and earned a PhD in 1958. By 1958, he had five publications (three joint) to his credit. His dissertation, ''A Study of Visual Binaries Having Primaries Above the Main Sequence,'' was directed by W. P. Bidelman, and foreshadowed his life's work: the application of spectral classification to the study of stellar evolution, galactic structure, and other astrophysical topics. Bruce was awarded the Astronomical Society of the Pacific's Dorothea Klumpke Roberts Prize in Astronomy in 1956.

Bruce then joined the Warner & Swasey Observatory of Case Institute of Technology (now Case Western Reserve University) in Cleveland, Ohio. He served as Instructor (1958–59), Assistant Professor (1959–64), Associate Professor (1964–68), and Professor (1968–94). In recognition of his many contributions to the Department of Astronomy and the University, Bruce was appointed the Worcester R. and Cornelia B. Warner Professor of Astronomy in 1988. Upon his retirement in 1994, he was named Worcester R. and Cornelia B. Warner Professor Emeritus of Astronomy.

Over the years, Bruce taught an amazing range of courses at both the undergraduate and graduate level, more than any other member of the department: introductory astronomy (both for astronomy majors and for liberal arts students), practical astronomy (his favorite), radio astronomy, astronomical spectroscopy, stellar atmospheres, stellar interiors, galactic structure, astronomical optics, senior seminar, and senior thesis. His lectures were highly organized and clearly presented. Bruce was a demanding teacher, and most students respected and admired his high standards. The large number of successful undergraduate astronomy students that came from Case over the decades of his presence owed much of their background to Bruce's classes. He supervised eleven PhD students, eight of whom stayed in astronomy.

C. Bruce Stephenson, 1929–2001
*Photograph by Roger Mastroianni*

In addition to teaching, Bruce served the department and the university by willingly and faithfully participating in all the academic ''housekeeping'' chores. Until his retirement, most of the departmental software was written by him. When the Warner & Swasey Observatory operated two telescopes in northeastern Ohio, the Burrell Schmidt (relocated to Kitt Peak in 1979) and the 36-inch reflector, Bruce contributed to the maintenance, scheduling, and instrumentation of both. The additional funds provided to him by the Worcester R. and Cornelia B. Warner Endowed Chair were invariably dedicated to the needs of the department, at one point even being used to cover our resident observer's salary when grant monies were no longer available. In all his actions and decisions the only criteria were what was best for astronomy and the department. He was a virtually selfless and ideal colleague.

During his career, Bruce's name appeared on over 120 scientific papers, the majority published in refereed journals. Most of these contributions were based on spectroscopic observations made with the Burrell Schmidt or its twin, the Curtis Schmidt, and the 36-inch reflector of the Warner & Swasey Observatory. When he came to Cleveland in 1958,

Bruce collaborated with J. J. Nassau on the Luminous Stars in the Northern Milky Way Survey, a joint project with the Hamburg Observatory. Although he was the junior partner, Bruce's insistence on careful calibration of the standards was a crucial contribution to the success of this program, and an early indication of the meticulous approach which characterized all of his work.

Later, when the Curtis Schmidt telescope of the University of Michigan was relocated to the Cerro Tololo Inter-American Observatory, he worked with Nick Sanduleak on the survey of Luminous Stars in the Southern Milky Way. Bruce is probably best known for ''A General Catalog of Cool Galactic Carbon Stars'' (published in 1973, second edition published in 1989), ''A General Catalog of Galactic S Stars'' (first published in 1976, second edition published in 1984), and the finding list of Hydrogen alpha emission stars in the Milky Way that included the famous object SS 433 (published with N. Sanduleak in 1977).

Together with Hugh M. Johnson, a friend from student days at Chicago, Bruce made the first optical identification of an X-Ray source (Sco X-l) in 1966, nearly at the same time that another group made the same identification. For extraneous reasons, the other group received most of the credit for this important independent and virtually simultaneous discovery.

At home, Bruce enjoyed observing with small telescopes from his backyard, reading science fiction and history, and writing poetry. The following sample reflects both his secular humanism and his passion for astronomy:

Dark is the grave that waits for me
But I know darker far.
It waits for those who never asked
The nature of a star.

Bruce is survived by his wife, Elizabeth (née Strong), whom he met at Northwestern University, where she was a student majoring in Astronomy. They married in 1952. For many years Elizabeth served as the librarian of the Warner & Swasey Observatory.

Peter Pesch
Case Western Reserve University

## MALCOLM M. THOMSON, 1908–2002

Canadian astronomy lost it longest serving member with the death, on 21 March 2002 at age 94, of Malcolm M. Thomson. Malcolm was born in Nelson, British Columbia, on 3 January 1908, the oldest of four children of a Baptist minister. Moving regularly as his father accepted periodic calls to serve new congregations, Thomson was educated in Edmonton and Winnipeg. He graduated in 1929 from the University of Manitoba with a BA in mathematics. Thomson then joined the staff of the Dominion Observatory in Ottawa, where his primary concern was the development of accurate radio time signals for Canada. Under his supervision, time signals were broadcast on CHU in the short-wave band as well as the daily signals on the national radio service. With the exception of three years of wartime service with the Royal Canadian Air Force as a navigation instructor, and one year of educational leave during which he earned an MSc degree in astronomy at Yale University, Malcolm spent his entire career in the time service. Over those forty years, he guided improvements at the observatory as technology advanced from pendulum to crystal and then atomic clocks. In 1970, responsibility for time keeping was transferred, as part of optical astronomy, to the National Research Council of Canada where Malcolm was head of the Time and Frequency Section until his retirement in 1972. His book, *The Beginning of the Long Dash: A History of Time Keeping in Canada*, was published in 1978. The title refers to the one o'clock official time signal still broadcast daily on FM radio.

Malcolm M. Thomson, 1908–2002
*Photo by Lloyd Brown, courtesy of Genevieve Thomson*

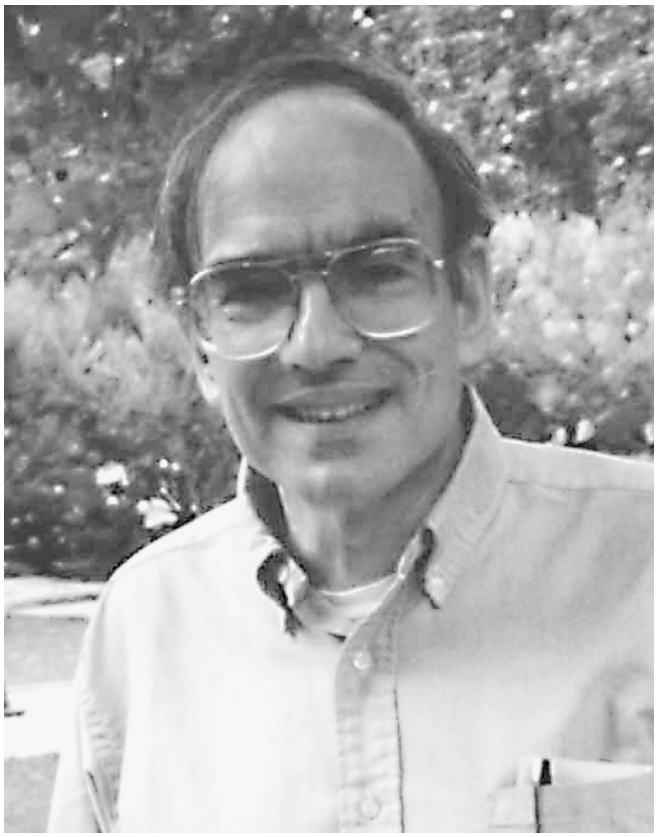
Malcolm Thomson was a most active participant in scientific and community activities. He served as president of the Royal Astronomical Society of Canada from 1966 to 1968 and on numerous national committees. Outside his professional duties, he was a leader in the programs of his church, service clubs, discussion groups and sports teams for youth. He participated in cross-country ski marathons until age eighty-five and enjoyed canoeing at the family cottage. He was also a ham-radio operator. His good health continued until only a few days before his death on the vernal equinox.

An exceptionally large family of friends will remember Malcolm Thomson but will miss his cheerful smile. His wife of sixty-one years, Genevieve (née Mathieson), two sons, Morley and Fletcher, and four grandchildren survive him.

Ian Halliday
Ottawa, Ontario

## DAVID JOSHUA VAN BLERKOM, 1942–2001

David Joshua Van Blerkom, Professor of Astronomy at the University of Massachusetts, died 16 February 2001 after



David J. Van Blerkom, 1942–2001
*Photo courtesy of Janet Van Blerkom*

a long struggle with a blood disease. He met with his classes up until three days before he died.

David was born in New York City on 21 August 1942 to Bernard and Molly Van Blerkom. He attended Bronx High School of Science and City College of New York. He did his graduate work at the University of Colorado at Boulder where in 1965 he met Janet Stober, a fellow graduate student and atomic physicist. They were married in March 1965. David's PhD thesis was on the spectra of planetary nebulae.

Radiative transfer was David's research specialty. He loved to find explanations for puzzling observations. This led him to work on problems at many wavelengths, beginning with hot stars but gradually moving toward the extended atmospheres of cool giants (SiO masers and radio CO line profiles). Although his favorite environment for problems was these giant stars, both hot and cold, he also worked on solar system problems such as light transmission through the Martian haze and through Saturn's rings. He was especially fond of Monte Carlo solutions for problems with complex geometries.

David was an excellent, dedicated, and popular teacher. His standards were high but they did not detract from his success in teaching. In 1969 he created a highly popular course ''Science for Readers of Science Fiction'' which he taught for many years. In addition to this and other undergraduate courses, David taught extensively in the graduate program in such courses as radiative transfer, interstellar matter, and numerical techniques. He also taught courses and workshops for regional secondary school science teachers. For the 1995–1996 academic year, he was awarded the University of Massachusetts Distinguished Teacher Award.

Reading widely, voraciously and with amazing recall, David had extremely diverse interests. He taught a course in Egyptian hieroglyphics in the University of Massachusetts Honors program for many years and was presented a special appreciation award from the Honors program for that and other work. In addition to his interest in Egyptian hieroglyphics, he also taught himself to read cuneiform and Mayan hieroglyphs. David served as the head of the University of Massachusetts astronomy program for 19(!!!) years, from 1980 to 1999. During that time his patience, fairness, and sense of humor made him respected and loved by students and colleagues. Who else would send out faculty meeting announcements that began with quotations from, for example, Emily Dickinson (''This is the hour of lead . First chill, then stupor, then the letting go.'')? David was a wonderful friend of more than 30 years. We shared an office as young professors and in later years would relax together at lunch or afternoon tea. I miss his scientific insight, wit, and cheerful conversation.

David is survived by his wife of 36 years, Janet, his three children Daniel, Suzanne, and Derek, a grandson, Aaron Van Blerkom, and his brother Jonathan. In addition to his membership in the AAS, David was also a member of the Royal Astronomical Society and the IAU.

Tom Arny
University of Massachusetts (Emeritus)a

**NATARAJAN VISVANATHAN, 1932–2001**

Known to his astronomical colleagues simply as 'Vis', Natarajan Visvanathan enjoyed their deep affection and esteem throughout his full and productive career. He was born on 23 February 1932 in Sankarankoil, Madras, India. His father, Natarajan Iyer was a criminal lawyer while his mother, Gangai Ammal was a housewife. In the year prior to Vis's birth, his parents lost seven of his older siblings in a cholera epidemic.

Vis was a precocious student and excelled in mathematics and Carnatic music. After completing a BSc in 1952 at Madras University in Thiruchi, he took some additional meteorological training and then joined the staff of the Kodaikanal observatory where he worked as a research assistant to Vainu Bappu.

Vis's association with Mount Stromlo spanned two phases—first as a graduate student in the early 1960s, and later as a staff member until his retirement in 1997. Recruited by Stromlo's Director, Bart Bok, Vis first came to Mount Stromlo to undertake his PhD studies in 1962. Bok had a passion for working with students, and an urgent desire to establish a world-class graduate school at Stromlo. Right from the start, Bok wanted his program to be international in composition and ethos, so he contacted colleagues around the world persuading them to act as his recruiting agents. Bappu, a former student of Bok's at Harvard, recommended Vis to Bok as a young scientist of the caliber he was seeking.

Vis was among the first dozen students whom Bok appointed. Vis chose as his area of thesis research the technically demanding field of polarimetry. This involves using special filters at the telescope to investigate how the light

Natarajan Visvanathan, 1932–2001
*Photo courtesy of the Research School of Astronomy and Astrophysics, the Austrailian National University*

from individual stars has been affected by the presence of magnetic fields and dust particles on its long journey through space. In 1965 Vis submitted a thesis entitled ''Polarization in the Galaxy and the Large Magellanic Cloud,'' and graduated with his PhD in May of the following year.

In 1966, Vis went to Mount Wilson and Palomar Observatories in California as a Carnegie Fellow. With his experience in polarimetry, he used the large telescopes there to make polarization observations of radio galaxies. He showed for the first time that the optical light from some of these objects does not come from stars; it is primarily synchrotron radiation emitted by electrons moving in a magnetic field.

While in California, Vis began a long and productive collaboration with Allan Sandage. Together they did a memorable polarization study of the filaments in the starbursting galaxy M82. They showed that the light of these filaments is polarized because it comes from the hidden inner regions and is scattered by dust. This was a novel and influential idea. From 1968 to 1972, Vis was a Research Associate and Lecturer at Harvard, returning to the Hale Observatories and California Institute of Technology as a Visiting Associate from 1972 to 1975.

In 1975, Vis returned to the Mount Stromlo as a staff member. The observatory became his career home for the rest of his working life. Here his interests moved to galaxy photometry, the field that made him famous. The colors of galaxies depend on how bright the galaxies are: very bright galaxies are systematically redder, because their stars have different chemical properties from those in the fainter galaxies. This is called the color-luminosity (C-L) relation for galaxies. It seems to be a universal relation, the same everywhere in the nearby universe. Vis developed the techniques to measure the C-L relation precisely, and acquired his well-deserved reputation as one of the few people in the world who could do precise and reliable photometry of galaxies.

The high point of Vis's work on galaxy colors came in a series of very influential papers with Sandage in the late 1970s, on the C-L relation for elliptical and S0 galaxies. These papers are still much cited, with more than 200 references for each paper in the series. One can use the C-L relation to measure the distances to galaxies, and in this way to estimate the elusive Hubble constant that, in turn, tells us how fast the Universe is expanding, thus yielding an estimate for its age. In the late 1970s, there was considerable controversy about the value of the Hubble constant. It was a stormy time in extragalactic astronomy. Vis used his observations to derive a value that disagreed with the value favored by most other workers at the time. He had the courage to stand by what his data were telling him. Now, twenty years later, we think we know the true value of Hubble's constant, and it turns out that the result that Vis obtained was very close to the current estimate.

Although Vis will be remembered particularly for his work on galaxy photometry, he had other research interests, deriving from his photometric skills. Two stand out:

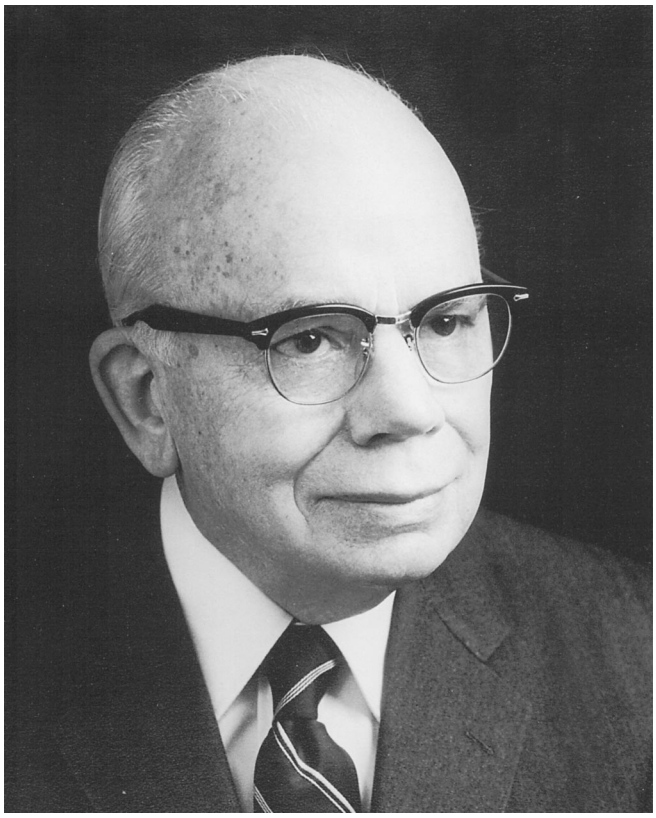
- With Don Mathewson and Vince Ford, Vis made an exciting study of the Small Magellanic Cloud, which showed that it is being ripped apart by its interaction with the neighboring Large Cloud.
- Vis had a long interest in a kind of magnetized variable star called AM Herculis objects—these show some dramatic changes that can be studied well with the photometric techniques that Vis was expert in. With Dayal Wickramasinghe and others, Vis published several papers about these stars.

Vis was an enthusiastic researcher and passed his enthusiasm on to his PhD students — David Griersmith, Andrew Pickles, Glen Mackie, and Anya Schroeder. We shall miss Vis, and we shall remember him. In 1961, Vis married Gomathi and the couple had one son, Kumar, and two daughters, Kala and Sudha. All three children obtained graduate degrees and are practicing in various biological or medical fields. We sympathize with his family in their sad loss when Vis died suddenly, while swimming at Stradbroke Island on 3 August 2001.

Don Faulkner
Ken Freeman
John Norris
Research School of Astronomy and Astrophysics,
Australian National University

## ALBERT EDWARD WHITFORD, 1905–2002

Albert E. Whitford, dean of modern photoelectric photometry, died in Madison, Wisconsin on 28 March 2002, following a brief illness. He was 96 years old, and had remained active in astronomical research well into his 90's. He will be remembered for his pioneering scientific work, his superb knowledge of astronomical instrumentation, his leadership in bringing the Lick 3.0m telescope into operation, his



Albert Edward Whitford, 1905–2002
*Photo by Willis Preston Campbell, courtesy of the Regional History Project, UC Santa Cruz.*

courage in the face of difficult administrative decisions, his perseverance, and perhaps most of all his profound integrity.

Whitford was born on 22 October 1905 in Milton, Wisconsin, the son of Alfred and Mary Whitford. He received his undergraduate education at Milton College, and earned his PhD at the University of Wisconsin, graduating in 1932. In 1937, Whitford married Eleanor Bell Whitelaw, and together they raised three children, William Curtis, Mary Eleanor and Martha Neill. Mrs. Whitford passed away in 1986. Whitford continued to reside in Santa Cruz, carrying on his research activities at UC Santa Cruz, before ultimately retiring in Madison, Wisconsin in 1996, where he could be closer to members of his immediate family.

In the face of loss, we are grateful to have two public records of Whitford's career, one in his own words: the memoir ''A Half Century of Astronomy,'' *Ann Rev Astron Ap*, 24, 1, 1986, and a later summary of his life's work, reported by Mike Rich and Don Terndrup, who as graduate students had been deeply touched by Whitford's counsel (''Bulges of Galaxies: A Celebration of the 90th Birthday of Albert Whitford,'' by R. M. Rich and D. M. Terndrup, *Pub. Astron. Soc. Pacific*, 109, 571, 1997). Here the importance of Whitford's research and especially the elements of his personality that I believe made it possible will be emphasized.

As an assistant to the redoubtable Joel Stebbins beginning in 1931, Whitford brought his knowledge of experimental laboratory physics into astronomy. A PhD physics student at the University of Wisconsin, Whitford had had experience measuring tiny electrical currents, similar to those produced by the primitive photoelectric cells that Stebbins used in his work at the small Washburn observatory refractor. Whitford employed vacuum tube technology to greatly amplify the photocell output, and encased the cell itself in a vacuum to reduce the noise produced from cosmic ray ionization. Application of these new techniques led to a great increase in the sensitivity limit. Carrying the new technology west to the 60- and 100-inch telescopes on Mt Wilson, Stebbins and Whitford began a long and fruitful collaboration in which they measured colors and magnitudes of stars in the North Polar Sequence and Selected Areas, as well as globular clusters and galaxies, and investigated the interstellar reddening of O and B type stars. In 1937, they introduced the so-called six-color photometry, extending magnitude measurements essentially from the optical UV cutoff out to 1 micron. In 1948, they pushed out to 2 microns using the PbS Cashman cell developed during World War II. Using this device they were able to trace the outline of the Galactic nuclear bulge, using the 100-inch telescope.

Of particularly lasting importance, resulting from further trips to Mt Wilson after Stebbins's retirement, was Whitford's six-color photometric study of near and distant OB stars, from which he obtained the ''Whitford reddening law'' (1958). This established the exact amount by which interstellar absorption increased with decreasing wavelength. This result provided the quantitative tools required to determine the effect, often severe, of interstellar dust on the colors and magnitudes of stars, and ultimately had a profound impact on the determination of the cosmic distance scale.

During the period when he agreed to become Director of the Lick Observatory and supervise the completion of the 3.0m Shane telescope and its full complement of instrumentation, Whitford had little time for personal research. But following his de jure retirement in 1973, he embarked on a new kind of research project that in effect was a renaissance for him: the study of the age and metallicity of the stellar population of the Galactic nuclear bulge. In 1978 he showed that the energy distribution of the population in Baade's window was similar to that of the bulges of spirals and elliptical galaxies. Later, in collaboration with graduate student Mike Rich whom he mentored, and with support from the NSF, Whitford demonstrated that the bulge population was predominantly metal-rich, on the basis of spectra obtained with the Las Campanas 100- inch telescope. Additional collaboration with Jay Frogel, then staff astronomer at CTIO, led to a classical study of the infrared properties of the bulge population, particularly the late M-type giants. These studies in turn inspired graduate student Don Terndrup, mentored again by Whitford (and Sandy Faber), who imaged several bulge fields, and demonstrated, this time from color-magnitude arrays, that the population was indeed old, possibly as old as the globular cluster population, but nevertheless metal-rich.

In recognition of the importance of his research, Whitford received two of the astronomical community's highest honors: the Henry Norris Russell Lectureship of the American Astronomical Society (1986) and the Catherine Wolfe Bruce Medal of the Astronomical Society of the Pacific (1996). In addition, he was elected to the National Academy of Sciences and the American Academy of Arts and Sciences. He served the astronomical community as Vice-President (1965-

67), then President (1967-70) of the American Astronomical Society.

How Whitford succeeded so admirably in making profound contributions to astronomy is all the more remarkable when one considers that he had experienced no formal contact with the subject either during his undergraduate years at Milton College or his pre-PhD years in the Physics Dept of the University of Wisconsin. As he himself noted in the first paragraph of his memoir (*op. cit.*): ''An adult lifetime devoted to astronomical pursuits did not in my case evolve naturally out of youthful fascination with the stars. Any inclinations that stemmed from boyhood hobbies or early educational influences pointed in other directions.'' Yet during those early years of collaboration with Stebbins, Whitford prepared himself to play a leading role in his new profession, particularly after he was appointed assistant professor in the Wisconsin Astronomy Department (1938), which meant that formal teaching of astronomy was required. He goes on to say (*op. cit.*): ''Since I had never had any classroom instruction in the subject, this had the salutory effect of forcing on me a throrough review of the fundamentals of the subject.'' This response characterizes a seminal feature of Whitford's personality: perseverance. He learned astronomy by private study and teaching, by listening to the important figures of the day during visits to Mt Wilson, especially astronomers such as Walter Baade, and by doing real astronomy at the telescopes during and after his tenure as an NRC Physics Fellow (1933-35). This facet of character may well have sprung from his own family heritage of ''Yankee stock'' and the cultural traditions of Milton College, an educational institution with which his family had had a long history. But for whatever reason, this habit of perseverance lies, I believe, at the root of his post-retirement scientific renaissance. Always concerned with the colors and magnitudes of Galaxy bulges, Whitford took his interest a step further and learned all he could as background to his own study of the stars in the bulge of our own Galaxy, by reading and listening. Some who come into astronomy from the ''outside'' continue to practice their technical specialty, but do not ''learn'' astronomy from a broad perspective. Whitford was not among these: his way was the way of total immersion.

A further aspect of Whitford's character is found in his willing acceptance of serious responsibilities. Interrupting a budding astronomical career in 1940, he joined the MIT defense project in which microwave radar and its military applications were developed and which culminated in radar capable of detecting German U-boats then threatening shipping in the Atlantic. From 1948 onward, he chaired the UW Dept of Astronomy succeeding Stebbins as Director of the Washburn Observatory. He guided the planning and construction of the Pine Bluff observing station that was dedicated in 1958, shortly before he left to become Director of the Lick Observatory. In his leadership of Lick, he was brilliantly successful in bringing the 3.0m reflector, then the second largest telescope in the world, to completion. Serious problems had developed both in the telescope drive and the figure of the primary mirror. Whitford devoted his own personal talent to the solution of the problems and made the necessary, if contentious, changes in engineering personnel that were required. He further supervised, or supported others, in providing the then state-of-the-art instruments needed if the potential of the telescope was to be realized. In 1966, he supervised the complex move of the Lick scientific staff from Mt Hamilton to UC Santa Cruz, along with the shops and technical and administrative support personnel. Although initially a wrenching experience for a staff that had long identified itself with a mountaintop way of life, most soon recognized that campus life provided new research opportunities not available in a remote site. Whitford promoted a successful effort, with support from the NSF, to bring a cadre of theoretical astrophysicists to join the Lick astronomers in Santa Cruz, thus forming a new and more broadly based graduate program. The preservation and later expansion of the Lick shops provided a venue in which modern engineering personnel could be attracted, who in turn were responsible for advances in digital detector technology and modern complex optical fabrication. In later years, these shops became the nucleus of laboratory support for instrumentation at the Keck telescopes.

In 1962, Whitford served the entire astronomical community by chairing the first survey of astronomy under the auspices of the NAS. This led in 1964 to what became known as ''The Whitford Report,'' a plan for the public and private support of astronomy during the subsequent decade, and which had as its centerpiece the construction of what later became the 4.0m telescopes at Kitt Peak and Cerro Tololo. The Whitford Report became the model for later decadal planning documents. At the time, the report was deemed quite ''visionary,'' but as Whitford later noted, somewhat wryly, ''most of the recommendations . . . were finally implemented, but not in the originally projected 10-year period. In retrospect, these recommendations now seem rather modest.'' (*op. cit.*)

I did not know Whitford at all before 1967, when I joined the staff after the move from Mt Hamilton to Santa Cruz. My knowledge of his tenure on Mt Hamilton is therefore limited to what I have learned from others who lived and worked on Mt Hamilton at the time. A summary of those impressions, which seems consistent with my own post-1967 observations, is the following: Albert Whitford was kind, unswervingly loyal to the Observatory, scientifically and technically knowledgeable, scrupulously honest and fair, enormously respectful of scientific accomplishment, strongly supportive of staff who were doing good work. Personally, he was tireless, working in his office late at night, dealing with the necessary drudgery of administering Observatory affairs, honest and forthright, deeply concerned about being fair and democratic. I would add to this that Whitford was a man of reserved personality, quiet and introspective. He was not a ''political animal,'' and certainly not a ''glad-hander'' experienced in the nuances of University politics. The controversy that arose within the University of California concerning the governance of the resource represented by the newly-completed 3.0m telescope could not have been a challenge easily welcomed or managed by a man of Whitford's personality. Nevertheless, he succeeded admirably in fulfilling the wish of the staff to re-establish the academic and technical affairs of Lick on the newly opened UC Santa Cruz campus, where the

Observatory was welcomed with great enthusiasm.

Whitford enjoyed hiking in the Sierra even into advanced years. Mike Rich recalled his hardiness when, during one of their observing trips to Chile, Whitford tackled climbing a hill behind the Tololo compound, and went on hikes in the Elqui Valley, all this in his advanced years. Whitford especially liked travel to distant places. In the course of his life, he succeeded in setting foot on every continent. He took special pride in adding Antarctica to the list when in his 80's he stepped from a dinghy to the Antarctic shore, having boarded a cruise ship at Chile's Puerto Montt. He was also a fan of the San Francisco Opera. We went together on one occasion and I recall his being bowled over by Gwyneth Jones's portrayal of Isolde in Wagner's opera. Could this lie behind one of Whitford's especially trenchant bon mot's? When lamenting a bout with a staff member, he was heard to say ''I can put up with a prima donna, (long pause)....IF she can sing!''

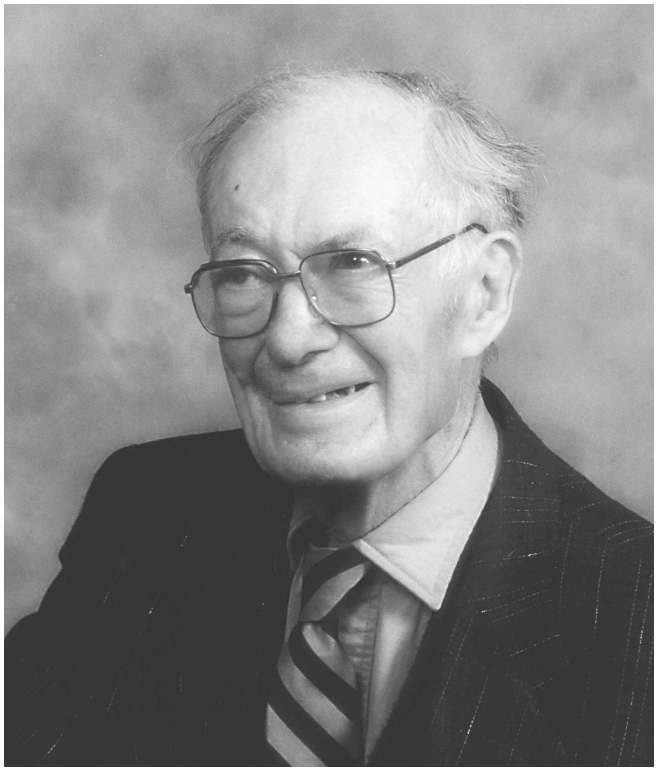
I am reminded too that, despite his generally quiet and thoughtful demeanor, Whitford was a very sociable dinner guest whose engaging remarks revealed his deep interest in national and international politics, in addition to astronomy. On other occasions, long and somewhat awkward pauses were a characteristic facet of his conversation. It was as if Whitford were searching for words of exactly the right weight, color and judiciousness before making any further commitment on a given subject. It was entirely in character. Of the several UCSC students who were mentored or advised by Whitford, and this includes Nick Suntzeff, Mike Rich, Don Terndrup, and Dave Burstein, all have spoken of his willingness to serve as a sounding board for their ideas as they struggled with the task of learning to do research astronomy. One spoke of Whitford's advice to take refereeing seriously, another his admonition to limit one's objectives in any given research paper and eschew diffuseness. Yet another recalled his surprise when he first observed Whitford in the course of a colloquium. ''Whitford would sit in the back of the room...with his eyes closed and one would think him asleep. Except, when the colloquium ended, he was usually the first with the most penetrating question possible!'' Albert Whitford was not a man given to garrulousness and did not wear his heart on his sleeve. But one could get to know him a bit more intimately with the slow passage of time. We were deeply impressed by his sharply informed knowledge of the research literature and his continued contributions to it almost to his 90th year. His sense of personal loyalty to Lick was deeply intertwined with his own research. Occasionally a visitor or even a staff member might express surprise, in Whitford's company, that a man in his 80s would make the daily sojourn to his UCSC office to do research, talk to students and faculty, and listen to the colloquia. To this comment, I recall that Whitford had an especially poignant response: ''But this is my home; this is where my family is.''

Robert P. Kraft
UCO/Lick Observatory

**KENNETH OSBORNE WRIGHT, 1911–2002**

Kenneth Osborne Wright died of the effects of Parkinson's disease on 25 July 2002, nearly nine months after celebrating his ninetieth birthday. He was born in Fort George, British Columbia, Canada, to Charles Melville and Agnes Pearl (née Osborne) Wright on 1 November 1911. His father was a Presbyterian minister. Ken spent almost all his life and virtually all his professional career in his native province. His student years, however, were spent at the University of Toronto. He graduated with a BA in 1933, winning the Gold Medal awarded by the Royal Astronomical Society of Canada (RASC) for the best student in the graduating astronomy class. Ken earned an MA in Astronomy in 1934, also at Toronto. During the academic year 1934–1935, Ken was an astronomical assistant at the University of Toronto. During the following academic year he held a similar post in the University of Michigan. In 1936, Ken returned to British Columbia to take up a full-time appointment on the staff of the Dominion Astrophysical Observatory (DAO) in Victoria. He was awarded a PhD from the University of Michigan in 1940 for a dissertation based on his research at DAO. Except for short absences at the University of Toronto (1960–1961), Mount Wilson and Palomar Observatories (1962) and Amherst-Mount Holyoke Colleges (1962), Ken remained at the DAO until he reached the then mandatory retirement age of 65 in 1976. For the last ten years of that period, he was the DAO's director. Precluded from active war service by a defect in one eye, Ken also served as a lecturer at the University of British Columbia in Vancouver during 1943 and 1944.

When Ken arrived at the DAO in 1936, virtually all work there was stellar spectroscopy (carried out, of course, with photographic plates) and, particularly, studies of spectroscopic binaries. Ken's dominant interest, the structure and chemical abundances of stellar atmospheres, fitted well with the Observatory programs. From early days he engaged in



Kenneth O. Wright, 1911–2002
*Photo courtesy of Michael MacNeill*

curve-of-growth analyses of stellar spectra. This naturally led him to consider the precision with which line intensities could be measured on stellar spectra—a topic ideally suited to his temperament. While, on his own admission, Ken could sometimes be hasty and hot-tempered with colleagues, for stars and spectrograms he had almost endless patience. Few of us took as much care as he did in focusing the spectrograph at the beginning of the night and even fewer were prepared to spend all night, and sometimes even two or three consecutive nights, to obtain just one plate. Nevertheless, with the early spectrographs in Victoria, that was often the only way to record as far as possible into the ultraviolet.

The conversion of a photographic record into an intensity trace must seem arcane to those who have grown up with solid-state linear detectors, to say nothing of computers. In the old days, spectrogram reduction required two stages; for each stage there was an instrument—a microphotometer and an intensitometer. Each of these instruments at Victoria had been designed by C. S. Beals, but Ken was probably their most frequent and most skilled user. Drawing the continuum for a late-type spectrum was a challenge in itself and, finally, when the intensity trace was complete, the measurements had to be made. Ken was frequently to be found on his knees, carefully examining a tracing that stretched the entire length of the corridor outside his office! Ken's dedication to this field was recognized by his peers when they elected him, in 1952, as president of IAU Sub-Commission 29b on Standard Line Intensities in Stellar Spectra. He served in that role for twelve years.

The climax of this work, and the fruit of Ken's efforts in Commission 29b, was a paper published in 1963, in the DAO Publications, which Ken wrote with the assistance of E. K. Lee and T. V. Jacobson and the collaboration of his friend J. L. Greenstein. Although modern detectors, with their high signal-to-noise ratios, and our improved theoretical knowledge of stellar atmospheres have greatly increased our ability to interpret the data, this paper stands as one of the most comprehensive discussions available of the variations of line intensities with spectral type along the main sequence. A second paper with T.V. Jacobson, published a little later, also considered the variations of line-intensity ratios with luminosity class in spectra of late types.

Another area of interest for Ken was that of long-period eclipsing binaries containing a supergiant component. Almost everyone at the DAO in the 1950s participated in the observation of these systems but Ken was the one who continued the work and made it especially his own. This was partly because the premature deaths of Andrew McKellar and Robert Petrie left him as the last active observer of the group that initiated the program, but study of these systems was also suited to his particular kind of patience. Few people are prepared, these days, to invest a lot of time in intensive observation of a prolonged eclipse, only to have to wait years before being able to repeat the observations. Of course, Ken's principal interest was in the atmospheric phases of the eclipses, when the light of the early-type companion acts as a probe, revealing the structure of the supergiant atmosphere. However, a by-product of his work was orbital elements of several of the brighter systems of this type. In particular, his orbital elements for VV Cephei remain the best available.

Ken was made assistant director of the DAO in 1960, after the early but not unexpected death of Andrew McKellar. He became director in 1966, after the sudden death of Robert M. Petrie. Naturally, there was less time for scientific research in his new position. It was his misfortune to be plunged into a senior administrative position at the time of considerable division within the Canadian astronomical community over the location of a proposed major new instrument. This division eventually led to the cancellation of the project amid fears, in some quarters, that Canadian astronomers would be denied access to large telescopes. Ken's persistence in supporting the efforts of G. J. Odgers to find alternative projects was a major factor in the eventual Canadian participation in the CFH Telescope, and thus, indirectly, in the other large-telescope projects in which Canadian astronomers are now involved. The difficulty of those times was increased for him by the illness and death, in 1969, of his first wife Margaret.

Ken was always ready to encourage amateur astronomers and he was active both in the RASC's Victoria Centre and at the national level of the society—he served as the RASC president from 1964 to 1966. In November 1940, Ken coordinated both local amateurs and the DAO staff in observations of a transit of Mercury, visible from Victoria.

Ken was also active in the wider community of Victoria. As an honorary professor of physics at the University of Victoria from 1965 to 1981, he served in the academic senate of that institution from 1973 to 1978. He was, for many years an elder of First United Church in Victoria.

Among the honors Ken received, were election as a Fellow of the Royal Society of Canada in 1954 and an honorary doctorate (DSc) from the Nicholas Copernicus University in Torun, bestowed in 1973 during the Extraordinary General Assembly of the IAU held in Poland to celebrate the quincentenary of the birth of Copernicus.

Ken married twice—to Margaret Sharp in 1937 and, after her death, to Jean Ellis, who died about a year before he did. He is survived by one daughter from the first marriage, Mrs. Nora Osborne.

In all that Ken did, he set himself the highest standards and was conscientious and meticulous in the extreme. His integrity was rock-like and his word completely reliable. If Ken sometimes criticized people quite strongly to their faces, they could be certain that he would never say anything behind their backs that he was not prepared to say directly to them, and he never nursed grudges. Astronomy and the DAO have changed much in the quarter-century since his retirement, but Ken left his mark on each of them.

Alan H. Batten
Dominion Astrophysical Observatory