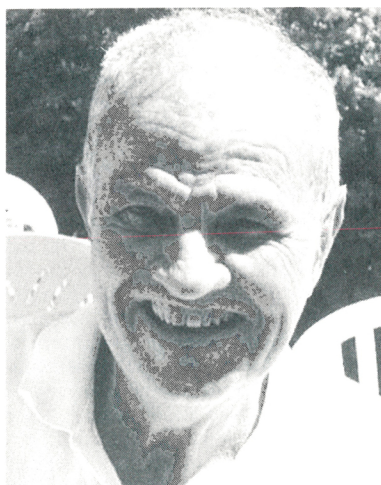




EARL WADSWORTH MCDANIEL

tions, which delved deeply into the microscopic behavior of ionized gases, his numerous scholarly monographs and the prominent scientists he trained.

Earl was born in Macon, Georgia, on 26 April 1926. He received his BS in physics from the Georgia Institute of Technology in 1948 and his PhD in physics in 1954 from the University of Michigan, where he specialized in radiocarbon dating. In 1954, he joined the physics faculty at Georgia Tech, where he became a professor of both physics and electrical engineering. In 1970, he was awarded the title of Regents' Professor, a post he held as an emeritus until his death.

Earl's long and prolific research career was outstanding in its originality and ingenuity. He developed one of the first crossed-beam experiments for the study of ionization and excitation in electron-ion collisions. And as leader of a large group of researchers, he spearheaded the measurement of heavy particle ionization cross sections at energies to the MeV region.

However, the real scientific passion of Earl's life was studying the transport properties of gaseous ions at very low energies. His work on ion mobilities, diffusion coefficients and ion-molecule reactions has left an immense legacy to the field. By applying mass spectrometry to drift tube studies, Earl opened a new era in the study of ionized gases. His careful and meticulous measurements set a high standard for the field and so greatly enriched our scientific knowledge of ion transport mobilities, longitudinal and transverse diffusion coefficients and the rates of ion-molecule reactions. As such, they provided the main impetus for the development of increasingly sophisticated theories of the motion of ions in the presence of neutral scatterers.

Ed Mason once remarked that the field of ion transport falls into two categories, the dinosaur age of "Before Earl" and the modern era of "After Earl." Indeed, the paper Earl wrote in 1968 with Dan Albritton, Tim Miller and David Martin, "Mobilities of Mass Identified H_3^+ and H^+ Ions in Hydrogen" (*Physical Review*, volume 171, page 94), was among the 100 included in the celebratory compendium *The Physical Review—The First Hundred Years: A Selection of Seminal Papers and Commentaries* (AIP Press, 1995).

Earl served as the doctoral adviser to many graduate students, who have gone on to follow successful and productive careers, with some reaching the highest ranks of the scientific community.

In addition to his numerous scientific research papers, Earl wrote or cowrote six books on atomic collisions and coedited nine other books dealing with the subject. His classic monograph *Collision Phenomena in Ionized Gases* (John Wiley, 1964) was considered the preeminent text in the field for many years and served as an inspiration for many who studied heavy particle scattering dynamics. Most recently, Earl updated his earlier work to produce a widely acclaimed succession of monographs.

Earl was much more than an outstanding physicist. He was larger than life in everything he did. He possessed a lively intellect and was a widely read scholar who pursued knowledge with the same verve and love that he showed for physics. He was an expert on the history of the great military conflicts, enjoyed fiction, was well versed in the classics and loved music. He enhanced our lives by embodying the highest goals to which we can aspire. Those who knew him will long remember his high scientific standards, exemplary integrity, convivial personality and occasionally outrageous sense of humor. We will miss his warmly given advice, loyal friendship and, most of all, his generously shared understanding of and zest for life.

JAMES GOLE
EDWARD THOMAS
TURDAY UZER

Georgia Institute of Technology
Atlanta, Georgia

Mark Aaron Samuel

Mark Aaron Samuel, a professor of physics at Oklahoma State University (OSU), died suddenly on 7 November 1997. He was 53.

Mark was born in Montreal. After obtaining BS and MS degrees at McGill University, he worked on finite quan-

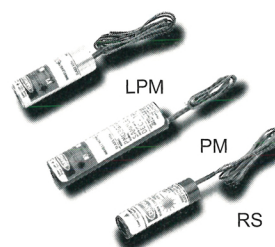
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tum electrodynamics with C. R. Hagan and R. W. Marshak at the University of Rochester, where he completed his PhD in 1969.

After leaving Rochester, Mark accepted a position as an assistant professor in OSU's physics department. When he arrived, there was no high-energy physics program anywhere in Oklahoma, as previous programs had never taken hold. As a young and energetic researcher, Mark rapidly established himself within the field of quantum electrodynamics and, in the mid-1970s, made significant contributions to the understanding of electron and muon anomalous magnetic moments.

Promoted to associate professor in 1975 and to professor in 1981, Mark was instrumental in bringing Karnig Mikaelian to OSU in 1979, and thus began one of Mark's most influential periods. He and Mikaelian worked on what turned out to be the remarkable discovery of "amplitude zeroes," for which the cross section for emitting a photon together with a W boson in high-energy hadron collisions should vanish at a point in phase space that is specified by the fundamental couplings of the electroweak theory. Amplitude zeroes are characteristic signatures of gauge theories, particularly of the electroweak $SU(2) \times U(1)$ theory, which Mark and his group developed extensively through the following decade. This analysis has inspired experimental tests at the Fermilab proton-antiproton collider that are just now bearing fruit.

In the 1990s, Mark's research interests turned to the use of Padé approximants to estimate higher-order coefficients in the perturbation expansions of field theories that cannot yet be calculated exactly. This investigative program used many insights from condensed matter and statistical physics with the particular aim of systematically understanding how to go beyond direct calculations in quantum chromodynamics. It culminated recently in a prediction of the four-loop renormalization-group function in QCD, which shortly afterward was confirmed with high accuracy by an exact calculation. Mark also used the Padé technique both to obtain interesting predictions in supersymmetric QCD and to refine analyses of data on polarized deep inelastic scattering and electron-positron annihilation.

Very active in the high-energy physics community, Mark helped to organize the Workshop on Nonperturbative QCD in 1983, and the conference entitled *Beyond the Standard Model II* in 1990—both held in Oklahoma. Mark was a member of the international advisory committee for the Be-

yond the Standard Model series of conferences.

Outside of research activities, Mark's career was typified by a deep concern for his students and by his participation in several pioneering educational initiatives within Oklahoma. These initiatives included being an advisory member of the Oklahoma School for Science and Mathematics, and being one of the first members of the North Central Oklahoma Physics Teachers Alliance. His enthusiasm for physics was projected to local high schools through those organizations, and his care and concern for the quality of physics education throughout the state were evident in all of his activities.

His colleagues and his many collaborators throughout the world will miss his mathematical ingenuity and his infectious enthusiasm.

MAREK KARLINER

Tel Aviv University

Tel Aviv, Israel

KIMBALL MILTON

University of Oklahoma

Norman, Oklahoma

STEPHEN MCKEEVER

Oklahoma State University

Stillwater, Oklahoma

Frank Bradshaw Wood

Frank Bradshaw Wood passed away in Gainesville, Florida, on 20 December 1997, one day short of his 82nd birthday.

Born in Jackson, Tennessee, Brad earned a BS in physics from the University of Florida in 1936 and a PhD in astronomy from Princeton University in 1941 under Henry Norris Russell. During World War II, he served in the US Navy and rose to the rank of lieutenant commander.



FRANK BRADSHAW WOOD

After teaching for a few years at the University of Arizona, he took a position in 1950 at the University of Pennsylvania, where he soon became chairman of the astronomy department and director of the Flower and Cook Observatory. Brad remained there as the Flower Professor of Astronomy through 1968, then accepted a position as professor of astronomy and director of the Optical Astronomical Observatories at his alma mater, the University of Florida.

Brad's contributions to research were primarily in the field of interacting binary stars. To his fellow astronomers, he was an untiring advocate of the importance of close binaries. Not only are the important physical parameters of stars in general—such as masses and radii—mostly obtained from binaries, but binaries of all types actually account for 60% of all stars, at least in the solar vicinity. Among the most notable of his papers were perhaps his pioneering, in-depth articles on the atmospheric eclipses of the supergiant stars (ζ Aurigae stars). His papers provided a new insight into the physical conditions of the extended atmospheres of those stars. He also set the stage for understanding the dynamical processes of close binary evolution by generalizing the "overluminous-for-its-mass" condition.

Brad also maintained the Card Catalog on interacting binary stars and edited several editions of *A Finding List for Observers of Interacting Binary Stars*, the last edition of which was published by the University of Pennsylvania Press in 1980 and contained over 3500 close binaries. The importance of this finding list was underscored when the discovery of x-ray binaries prompted the search for their optical counterparts. The *Finding List* remains a vital tool of research for those who study binary stars.

Brad was active in scientific organizations such as the American Astronomical Society, the American Association for the Advancement of Science and the International Astronomical Union. He was president of IAU Commission 42 (close binary stars) and of Commission 38 (exchange of astronomers) and served on the AAS council.

One of Brad's greatest legacies to research has been his former students. Tellingly, three of them have followed in his footsteps to serve as president of IAU Commission 42. Brad is warmly remembered by his former students as a caring and gracious teacher.

YOJI KONDO

*Goddard Space Flight Center
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