Edward Raymond Andrew

Edward Raymond Andrew, a pioneer in the development of nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI), died of cancer in Gainesville, Florida, on 26 May 2001.

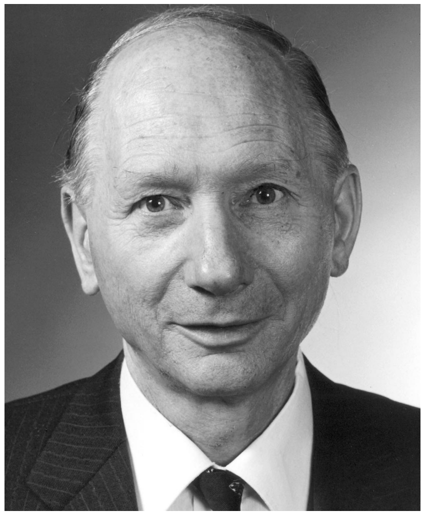
Raymond was born on 27 June 1921 in the Lincolnshire town of Boston, England. He attended Christ's College, Cambridge University, earning a BA in natural sciences with a specialty in physics in 1942. After spending the next three years on wartime radar research at the Royal Radar Establishment at Malvern, he returned to the university's Cavendish Laboratory and, in 1948, completed his PhD in physics; he conducted his research on superconductivity under the direction of David Shoenberg.

In the Shoenberg group meetings, he was introduced to NMR, which became the focus of his career. In 1948, Raymond went to Harvard University, where he worked under Edward Purcell, who later went on to share the 1952 Nobel Prize in Physics for the codiscovery of NMR.

In 1949, Raymond became a lecturer at St. Andrews University in Scotland, where he designed what was, at that time, the largest permanent magnet in Britain. Shortly thereafter, he began to study molecular motions as manifested in NMR line shapes and relaxation times. In 1953, he used NMR to provide the first demonstration of molecular diffusion in the solid state.

A year later, he was appointed as a professor of physics at the University College of North Wales, Bangor. The next year, he published the first book on NMR, *Nuclear Magnetic Resonance* (Cambridge U. Press).

In 1959, Raymond introduced magic-angle spinning, a technique that revolutionized the study of solid samples by NMR. This technique sprang from his work on line narrowing that accompanies conformational dynamics and motional averaging in solids. He realized that physically spinning a solid sample about the "magic angle" of 54.7° to the magnetic field would achieve the same result. Using this technique, he became the first to resolve a spin multiplet pattern in a solid sample. Raymond's studies of quadrupolar nuclei led to a method for distinguishing quadrupolar from dipolar relaxation, and his investigations of the anisotropies in relaxation and chemical shift provided further insights.



EDWARD RAYMOND ANDREW

Raymond became the chair of physics at Nottingham University in the UK in 1964 and was dean of the Faculty of Science there from 1975 to 1978. Under his leadership, Nottingham became world-renowned for its NMR research and its development of MRI. An image of a lemon, obtained by his laboratory, graced the cover of *Nature* in 1971.

In 1983, Raymond moved to the University of Florida, Gainesville, where he served from 1984 to 1991 as the founding editor of the journal *Magnetic Resonance in Medicine*. At Florida, he extended his studies of the relaxation and dynamics of a number of biologically important molecules in both solid state and solution. He and his collaborators designed gradient coils for microimaging and obtained exquisitely detailed high-resolution images of the spinal cord. Raymond played an important role in establishing the National High Magnetic Field Laboratory in Tallahassee, Florida.

In 1984, Raymond was elected as a fellow of the Royal Society and a joint winner of the Royal Society Wellcome Medal and Prize. He also was especially proud to be a joint winner of the American Physical Society's centennial contest for the most distinguished PhD lineage—with four Nobel laureates in his family tree!

In his 50 years as a scholar and teacher, Raymond trained 37 graduate students and nearly that many postdoctoral researchers. His lectures, expositions of his deep scientific insight, were a marvel of clarity and detail. He had a special knack for tuning his presentations to exactly resonate with his audience, the hallmark of a great teacher.

Raymond mentored many scientists from around the world. He was especially supportive of scientists from countries with limited scientific resources. As an editor, he was fair and thorough, often taking extra time with the manuscripts of authors whose science was not yet prominent, giving them extra advice and encouragement.

He was an engaging conversationalist, with a keen sense of humor and of intellectual curiosity. He had a wonderful smile and a twinkle in his eyes that showed an occasional hint of mischievousness. He enjoyed life, people, travel, and science, and he loved to talk about his travels and the people he met.

Those who knew Raymond treasure most his personal qualities: He was kind, compassionate, polite, and respectful of others. He was a devoted husband and extremely proud of his family. He was an excellent manager and organizer whose great contribution was the ability to create a climate in which work of the highest quality could flourish. He had encouraging, patient words of advice and wisdom for fledgling students and colleagues. He was the epitome of a scholar and a gentleman, and an academic statesman who shall be greatly missed but remembered with joy.

RICHARD W. BRIGGS
University of Florida
Gainesville

Arthur Falnes Davidsen

Arthur Falnes Davidsen, a leader in the study of the intergalactic medium, founding director of the Center for Astrophysical Sciences at Johns Hopkins University, and a key player in bringing the Space Telescope Science Institute to the Johns Hopkins campus, died in Baltimore, Maryland, on 19 July 2001 from complications related to a lung disorder.

Davidsen was born on 26 May 1944 in Freeport, New York, to parents of Norwegian descent. He attended Princeton University, receiving his AB in physics in 1966. Although accepted into the University of California, Berkeley, for graduate school, he first served five years as a naval officer, initially on a destroyer and then at the Naval Research Laboratory in Washington, DC, where, through his

ARTHUR FALNES DAVIDSEN

association with Herbert Friedman, he was introduced to x-ray astronomy. Davidsen earned his MA in astronomy from Berkeley in 1972. He continued to work in x-ray astronomy with Stuart Bowyer at Berkeley and earned his PhD in astronomy in 1975. Davidsen's thesis was entitled "Optical Observations of Compact X-ray Sources."

In 1975, he joined Johns Hopkins as an assistant professor of physics and became a professor of physics in 1980. In 1977, Davidsen, together with William Fastie and George Hartig, successfully conducted a sounding rocket campaign to obtain the far ultraviolet spectrum of the quasar 3C 273. The absence of prominent absorption shortward of the Lyman-alpha feature in the quasar's spectrum demonstrated clearly for the first time that the local universe was devoid of cool intergalactic gas.

In 1978, under NASA's Spacelab program, Davidsen proposed to build and fly a meter-class far ultraviolet telescope and spectrograph on the space shuttle. His proposal was accepted in 1979, well before the space shuttle first flew, and the Hopkins Ultraviolet Telescope (HUT) became the major effort in Davidsen's career for the better part of the next two decades. Although suffering a number of setbacks, including a four-year delay arising from the Challenger accident in 1986, the payload ultimately flew two successful missions, Astro-1 in December 1990 and Astro-2 in March 1995. During the March mission, Davidsen was able to realize his initial goal of using HUT to make a definitive measurement of the intergalactic medium using a high-redshift quasar as a background source. By carefully analyzing the resulting spectrum, Davidsen and colleagues were able to detect and measure a long-sought hotter component of the intergalactic medium.

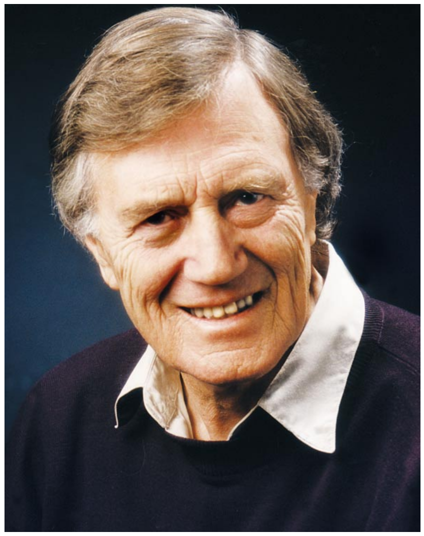
Davidsen played a leading role in developing, in 1979, the joint Association of Universities for Research in Astronomy–Johns Hopkins proposal that led to the siting of the Space Telescope Science Institute on the Johns Hopkins campus. This event led to an expansion of astrophysics in the physics department and an overall growth in what is now known as the department of physics and astronomy.

Davidsen's leadership in the astrophysics community was evident in his dedicated work on many panels, boards, and committees. He served as interim dean of the Krieger School of Arts and Sciences at Johns Hopkins in 1997 and, at the time of his death, was serving a term as chair of the Sloan Digital Sky Survey project's advisory council. In addition to being the principal investigator of HUT, he was a coinvestigator on the Hubble Space Telescope Faint Object Spectrograph team and many other instrumentation projects. In 1979, the American Astronomical Society awarded Davidsen the Helen B. Warner Prize.

Davidsen's coworkers will remember his consummate gentlemanly manner. Rarely seen in jeans or heard to raise his voice, he had an unselfish concern for students and more junior colleagues. Yet a contrasting side of him was rarely evident to scientific colleagues: He was a talented, albeit amateur, rock musician and rode a Harley-Davidson motorcycle for relaxation. Far too prematurely, the astrophysics community has lost a great colleague and friend.

Paul D. Feldman
William P. Blair
Johns Hopkins University
Baltimore, Maryland
Bruce Margon
Space Telescope Science Institute
Baltimore, Maryland

Bruce Sween Liley



Bruce Sween Liley

Bruce Sween Liley, one of the pioneer physicists in the UK's fusion research program, died on 19 May 2001 in Hamilton, New Zealand, after a long and stoic battle with a debilitating respiratory illness. During the 15 or so years of his career when he was closely involved in experimental fusion research, Liley played an important and highly original role in the long and continuing quest for nuclear fusion power.

Liley was born on 7 September 1928 in Havelock North, New Zealand. He obtained an MSc in mathematics in 1951 from Otago University College, University of New Zealand, and a master's degree in physics in 1955 from Auckland University College (now the University of Auckland).

Liley worked on a team that was developing George Thomson's ideas for building a thermonuclear reactor to produce power from the fusion reactions of hydrogen discovered in the 1930s by Mark Oliphant and Ernest Rutherford. Thomson received a patent in 1948 to produce useful power from these reactions and started a group, led by one of us (Ware), at Imperial College London to work on this idea. When the UK fusion program was classified in 1951 because of fears that the research could lead to a source of neutrons for breeding plutonium, the group moved to the Associated Electrical Industries (AEI) Research Laboratory at Aldermaston. Another fusion research group, this one at Oxford University, later moved to the Atomic Energy Research Establishment at Harwell and became the forerunners of the present Culham Laboratory.

Liley joined the team at AEI shortly after its start and quickly became the leading theoretician supporting the experimental program. While at AEI, he enrolled as a graduate student at the nearby Reading University and did theoretical research for his PhD, which he earned in 1963. His research involved adapting Harold Grad's 13-moment approximation to obtain transport equations for a fully ionized plasma, and his findings were published in *Reviews of Modern Physics* in 1960. Those equations are still being used in present research.

Thomson's patent evolved into the Sceptre series of devices—which, like the Harwell machine Zeta, would nowadays be called reversed field pinches—ending with Sceptre IV in 1959–60. Although a theoretician by training, Liley was at the heart of this work. He proposed and helped design an alternative to the Sceptre–Zeta approach: a levitron, which was essentially a current-carrying ring suspended in a vacuum chamber. But, before Liley's apparatus could be properly exploited, AEI decided to close the laboratory in 1963 because of funding problems. The entire team was dispersed, many to fusion laboratories around the world.

That same year, Liley joined the Australian National University (ANU) in Canberra to work in the Research School of Physical Sciences that had been formed by Oliphant after World War II. Liley's team built a device similar to that at AEI but with much stronger toroidal magnetic fields. Liley called his new device a "slow toroidal theta-z pinch." In modern terminology, the slow theta-pinch aspects would be referred to as adiabatic compression of the toroidal field. The experiment LT-1—which, on acquiring upgrades of its power supplies also upgraded its name to LT-2 and LT-3—was a pilot for what Liley later hoped would be a much larger experiment along these lines.

That larger experiment was not to be built during his residence in Canberra, but the pilot experiment was interesting in its own right. Having a strong toroidal field, the device Liley's team built operated in much the same way as the early Russian tokamaks. Deleterious periodic "disruptive instabilities" plagued both sorts of device. Eventually, extensive Russian efforts were devoted to successfully avoiding these instabilities and producing a hot, well-confined plasma. Liley's group decided to study the instabilities in detail; they produced important insights into the phenomenon, for example, that a disruption rapidly redistributed the current throughout the plasma column (see the article by David Bowers and others in *Plasma Physics*, vol. 13, 1971, page 1201). That phenomenon is still the most serious limitation to tokamak operation. Their work also stimulated development of the Ware pinch effect theory.

The LT-1 experiment, which became operational around 1965, can