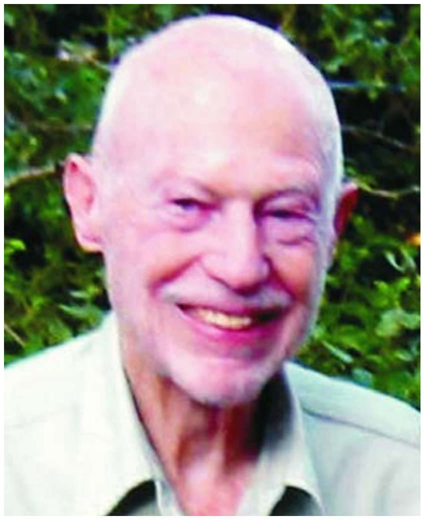
Bryce Seligman DeWitt

Bryce Seligman DeWitt, professor emeritus in the physics department of the University of Texas at Austin, died on 23 September 2004 after a courageous yearlong fight against cancer.

Bryce was born on 8 January 1923 in Dinuba, California, as the eldest of four boys. An exceptionally bright student, he was admitted to Harvard University at age 16. On graduating in 1943 with an SB in physics, he enlisted in the US Navy as a naval aviator, but the war ended before he was eligible to be sent on a mission. He returned to Harvard in 1946 as a PhD student under Julian Schwinger. Bryce received his doctorate in 1950 for his dissertation entitled "Quantization of the Gravitational Field."

He began postdoctoral work at the Institute for Advanced Study in Princeton, New Jersey. By a happy stroke of good fortune, Cecile Morette, a French mathematical physicist, joined the institute at the same time, and she and Bryce fell in love and were soon married. They also became lifelong intellectual sparring partners, with Cecile's love of French-style mathematical formalism contrasting vigorously with Bryce's more pragmatic American approach to the use of mathematics in physics.

Throughout Bryce's career, the focus of his research was the challenge of quantizing the gravitational field. In 1956, through the efforts of John Wheeler, he became the director of the Institute of Field Physics at the University of North Carolina at Chapel Hill. By studying the radiation of a gravitationally accelerated charge—a problem that he solved brilliantly—he discovered the basic properties of Green's functions in curved spacetime and became an enthusiastic advocate of their use in Rudolph Peierls's definition of the Poisson bracket. Bryce subsequently started on his major quest: to find a unification of quantum theory and general relativity that would respect the spacetime symmetries of general relativity. He tackled that challenge from a variety of perspectives. For example, using the Hamiltonian ("canonical") approach, he arrived at what came to be known as the Wheeler–DeWitt equation, the quantum gravity analog of the Schrödinger equation. The Wheeler–DeWitt equation was used frequently in subsequent quantum cosmology studies.



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In 1961, Richard Feynman showed how to conserve probabilistic quantum predictions while respecting general-relativistic covariance, a breakthrough in the non-Hamiltonian ("manifestly covariant") approach. But Feynman's results applied only to the lowest order of semiclassical theory. By 1964, Bryce had extended this work to the next order. Many of his preliminary ideas had been presented a year earlier in his famous Les Houches lecture course "Dynamical Theory of Groups and Fields." His book of the same title (Gordon and Breach, 1965) inspired a generation of theoretical physicists. The key new ideas came to be known as the Schwinger–DeWitt technique. The solution of the problem to all orders appeared in Bryce's fundamental *Physical Review* papers of 1967, a trilogy that remains one of the great tours de force of theoretical physics research.

Bryce was involved with many other areas of research. He actively promoted Hugh Everett's ideas on quantum theory and became the foremost champion of the many-universes interpretation. He also contributed to research in classical general relativity, always placing particular emphasis on the underlying physical meaning of Albert Einstein's edifice. Bryce was one of the pioneers in studies of the Hawking effect and in the use of computers to model the colliding black hole problem. In the mid-1980s, Cambridge University Press published his book *Supermanifolds*, which brought together in the first systematic way many topics of importance in the study of supersymmetry. His last book, *The Global Approach to Quantum Field Theory* (Oxford U. Press), a massive 1042 pages, was published in 2003 when he was 80 years old.

As a scientist, Bryce was bold and extraordinarily clear thinking. He eschewed bandwagons and the common trend of trying to maximize one's publication list: Most of his papers are long masterpieces of thought and exposition. Indeed, Bryce had a rare, perfect combination of physical and mathematical intuition and raw intellectual power that was very rarely surpassed.

Bryce was named the recipient of the American Physical Society's Einstein Prize for 2005. He received the Pomeranchuk Prize of the Institute of Theoretical and Experimental Physics (Moscow) in 2002; the Marcel Grossmann Award, with Cecile, in 2000; and the Dirac Medal of the Abdus Salam International Centre for Theoretical Physics in 1987. Yet, notwithstanding those and many other accolades for his work, he was arguably one of the most underappreciated scientific leaders of the late 20th century. Surely, his works will continue to live after him and to inform research for generations to come.

Bryce was an indefatigable trekker and mountain climber, and traveled widely. He was unfailingly generous, kind, and courageous, a person of the utmost integrity and honesty in all he did. He had a certain natural reserve, and those who did get close to him valued his friendship enormously.

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Godfrey Newbold Hounsfield

The year 1972 will live in scientific history: On 21 April of that year, Godfrey Newbold Hounsfield presented the results of his development to an unexpecting audience. At the 32nd Congress of the British Institute of Radiology, he delivered his paper "Computerised Axial Tomography." He described to the audience a new means of demonstrating some of the soft tissue structures of the brain without the use of contrast media. For that work, he and Allan M. Cormack received the Nobel Prize for Physiology or Medicine in 1979. Hounsfield died on 12 August 2004 in Kingston upon Thames, England.

A quiet, unassuming person, Godfrey was born on 28 August 1919 in Newark, England, and grew up nearby on a farm in Sutton on Trent. Although he did not excel at school, he was known for experimenting with electronics and the farm's mechanical and electrical machinery, and for building a homemade hang glider to test the principles of flight from haystacks. When World War II broke out in 1939, he joined the Royal Air Force (RAF) and found himself building an oscilloscope and carrying out radar R&D.

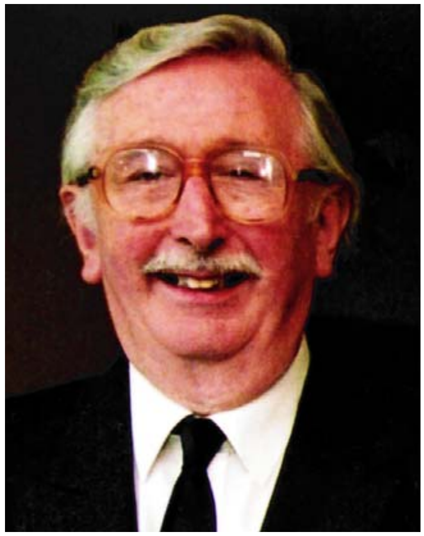
Although Godfrey never received a PhD, he had enrolled in a college course just before the start of the war. Following his discharge from the RAF, he won a government grant to the Faraday House Electrical Engineering College in London, from which he graduated in 1951. That same year, he joined the research staff of Electric and Musical Industries (later known as EMI).

Godfrey could well have been remembered for his significant contribution to the computer field, because in 1958 he was responsible for the development of the first solid-state computer in the UK, the EMIDEC 1100. After that effort, he was asked to add his intellect to the area of pattern recognition, in which EMI had a project team.

One day around 1967, as he walked the countryside—an activity he was keen on doing—his work in the area of pattern recognition combined with his work in computers to spark the realization that if sufficient measurements were taken of an energy beam around an object, it should be possible to calculate the structure within the object.

Following the initial theoretical calculations, Godfrey constructed a laboratory model using a lathe bed. His early model used a gamma source placed on one side of the specimen object and a detector on the other. The specimen object was rotated 1 inch at the end of each sweep. Each scan generated 28 000 measurements, which were digitized and recorded onto paper tape that was then fed into a computer system for processing.

The early pictures were encouraging, but it took nine days to scan an object and 2-½ hours to process each scan on a computer. The result of the processing was paper-tape output that was used to modulate a spot of light on a cathode-ray tube in front of a camera to produce a photograph, a process that took an additional 2 hours.



Godfrey Newbold Hounsfield

One of the first pictures using Godfrey's model, an image of a human brain, was of a museum specimen and showed good gray-white matter differentiation. Unfortunately, further study showed that the formalin used to preserve the brain had caused the readings to be enhanced. Godfrey then took pictures of animal specimens and proved that differences within the brain could be clearly seen. He often recalled stories of traveling across London on the subway with bullocks' brains and parts of pig bodies in a carrier bag.

It was obvious that a long scan time would not be feasible for a clinical system. After some experimentation, Godfrey chose x rays as the energy source. He approached the Department of Health and Social Security in London for support in building the clinical prototype; Godfrey and his funding agency agreed on a scan time of 4 minutes and an accuracy of 0.5% in pixel density.

In 1971 at the Atkinson Morley Hospital in South London, a woman with a suspected brain tumor was the first human patient to undergo a scan. The resulting picture clearly showed a dark lesion. Godfrey was still reserved; he feared that would just be the luck of the first clinical experiment. Not until he had scanned several patients and processed the pictures did he become convinced that the system was going to be sensitive enough to distinguish between normal and abnormal brain tissue. Godfrey's model then evolved from being simply a brain scanner to the whole-body scanners with which we are familiar today. His R&D interests moved beyond computerized tomography to provide a significant contribution to the field of magnetic resonance imaging development.

The invention of the CT scanner revolutionized x-ray investigation, which had remained virtually static since the turn of the 20th century, following Wilhelm Konrad Roentgen's discovery of x rays. Certainly it was the most significant development in the field of neurological diagnosis since Walter Dandy's air encephalography in 1918. In recognition of his contribution to CT scanning technology, Godfrey's name was given to the absorption scale (Hounsfield units) that identifies the x-ray attenuation in CT images.

Godfrey headed EMI's medical systems section from 1972 to 1976, became a senior staff scientist in 1977, and retired from EMI in 1986. He received numerous awards, including a knighthood from Queen Elizabeth II in 1981.

Godfrey was a keen lover of jazz and played it on the piano. He was also an eccentric; one particular example of his eccentricity was his insistence on remaining on UK time wherever he was in the world. He was even known to insist on presenting a lecture at 10am Greenwich Mean Time, even if it meant the audience attended at what was the middle of the night locally.

He disliked lecturing, the publicity, and the public activities that the invention of CT gave him, and preferred instead to dedicate his time to his R&D projects. Whenever possible, he would decline requests for lecturing or find a colleague to fill in for him. He was passionate about his research and dedicated to increasing his knowledge and to looking for other areas in which technology could improve medicine.

Elizabeth C. Beckmann
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Fred Lawrence Whipple

At the first press conference after the *Stardust* spacecraft flew past comet Wild 2 in January 2004, a reporter asked, "What is a whipple?" Like Edwin Hubble, another great astronomer had become synonymous with a piece of space hardware. The first part of the answer was that a whipple is a Whipple bumper, a clever, lightweight structure invented by Fred Lawrence Whipple and designed