Norman Ramsey

(1915–2011)

Physicist behind precision spectroscopy and atomic clocks.

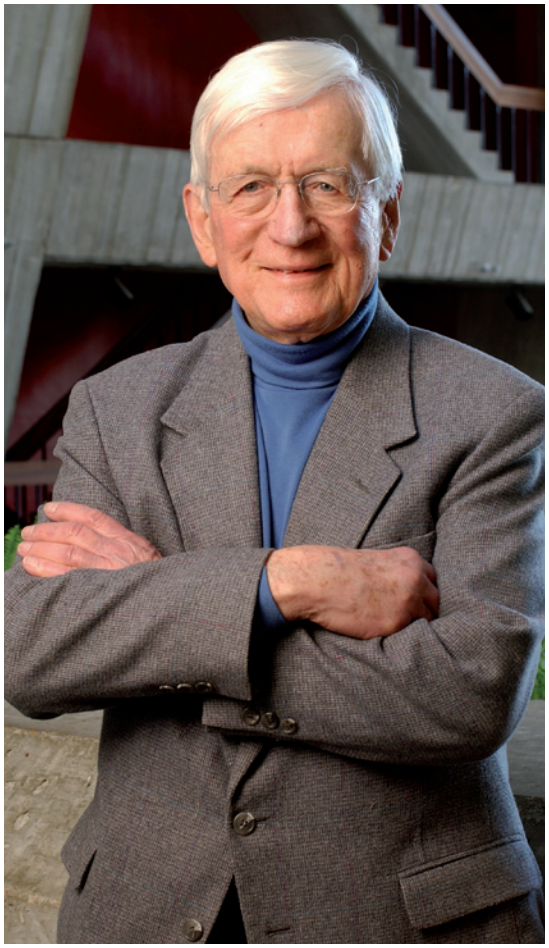
In the fields of atomic and molecular physics, Norman Ramsey's name is synonymous with a technique for precision spectroscopy, which earned him a share of the 1989 Nobel prize. Beyond the lab, he was also respected as a scientific statesman, admired for his fairness and integrity, his energy and unfailing good humour. Over his long career he inspired generations of physicists, including the 84 graduate students whom he supervised.

Ramsey, who died aged 96 on 4 November, was born in 1915 in Washington DC, the son of an Army officer and a mathematics teacher. He entered Columbia University, New York, in 1931, majoring in engineering and then shifting to mathematics. On graduation, he studied physics at the University of Cambridge, UK, working for two years alongside pioneers of nuclear physics such as J. J. Thomson, Ernest Rutherford and James Chadwick.

Returning to Columbia in 1937, Ramsey became a graduate student in the group of Isidor Rabi. Just a few months later, Rabi invented a revolutionary method for studying the structure of atoms and molecules, using streams of irradiated molecules in a vacuum. Ramsey's research blossomed: he shared in the discovery that the deuterium nucleus (a proton and neutron) is not spherical, implying that nuclear forces do not act along the line between the nuclei.

Shortly after receiving his PhD in 1940, Ramsey joined the war effort at the MIT Radiation Laboratory in Cambridge, Massachusetts, developing radar systems; later he worked on the Manhattan Project. Following the war, Ramsey returned to Columbia. With Rabi, he helped found Brookhaven National Laboratory in Upton, New York, serving as the first chair of its physics department. In 1947, Ramsey moved to Harvard University, where he remained for the rest of his career as the Higgins Professor of Physics.

At Harvard, Ramsey undertook a series of classic studies on nuclear and magnetic interactions within molecules, which helped to lay the foundations of the theory of 'chemical shifts' for nuclear magnetic resonance and magnetic resonance imaging, as well as revealing many properties of nuclei, such as their magnetism. He is best known for inventing the separated oscillatory field method — today known simply as the Ramsey method — in which particles are subjected to two pulses of temporally separated radiation, improving the resolution with which their energy structure can be measured. The method is now ubiquitous in high-precision and quantum physics, and is an essential ingredient in many atomic clocks.



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In another breakthrough, Ramsey and his student and colleague, Daniel Kleppner, found a way to confine hydrogen atoms for a relatively long time, typically a second, thereby enabling the atoms to radiate into a resonant microwave cavity. The result was the hydrogen maser, which emits stable radiation at the atoms' resonant frequency (a wavelength of 21 centimetres) and today has a key role in the Global Positioning System and in radio astronomy. The maser was also used in 1980 to demonstrate precisely Albert Einstein's prediction that clocks run at different rates in different gravitational potentials.

As a scientific statesman, Ramsey served as first assistant secretary general for science in NATO in 1958 and 1959, establishing summer schools and fellowships that helped to educate a generation of post-war European physicists. He founded the Harvard cyclotron, and later chaired the Harvard–MIT Cambridge Electron Accelerator. For 16 years he served as president of the University Research Association, which managed the construction and operation of Fermilab in Batavia, Illinois.

During Senator Joseph McCarthy's anti-communist witch-hunt of the early 1950s, Ramsey appeared on television to rebut attacks on his colleague Wendell Furry and on Harvard University. Although he disagreed with Furry's political views, he said that "true freedom gives a man not only the right to make a right choice but also the freedom to make a wrong choice". In the 1980s, he chaired the National Research Council committee that concluded that acoustic evidence did not support the idea that a second gunman was involved in the assassination of President John F. Kennedy.

When I was one of Ramsey's graduate students, he was heavily occupied with Fermilab. Yet he seldom, if ever, missed the weekly group meetings with students at Harvard, always offering his encouragement. Even in his later years, when he wound down his research group, he continued to lecture and participate in conferences, attending almost every session and engaging with students and senior scientists alike.

Ramsey's enthusiasm and energy were legendary. At a group outing to a beach on a cold and windy day during my graduate-school days, he was the only one in the water — trying out his surfboard. And in his eighties he trekked through Nepal with his wife, hiking for miles with a severed Achilles tendon.

Norman Ramsey was a towering figure in physics. Through his accomplishments, community service, warmth and high ethical standards, he was an inspiration to many. ■

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