Robert Richardson

(1937–2013)

Discoverer of superfluidity in helium-3.

Robert Richardson, along with physicist David Lee and myself, discovered that helium-3, a rare but stable isotope of helium, becomes a superfluid when cooled to a minuscule fraction of a degree above absolute zero. Until that discovery, in the early 1970s, the superfluidity effect — in which a liquid flows without friction — had been seen only in helium-4, whose atoms are bosons. No one had been able to produce the phenomenon with fermions, whose nuclei have spin properties different from those seen in bosons.

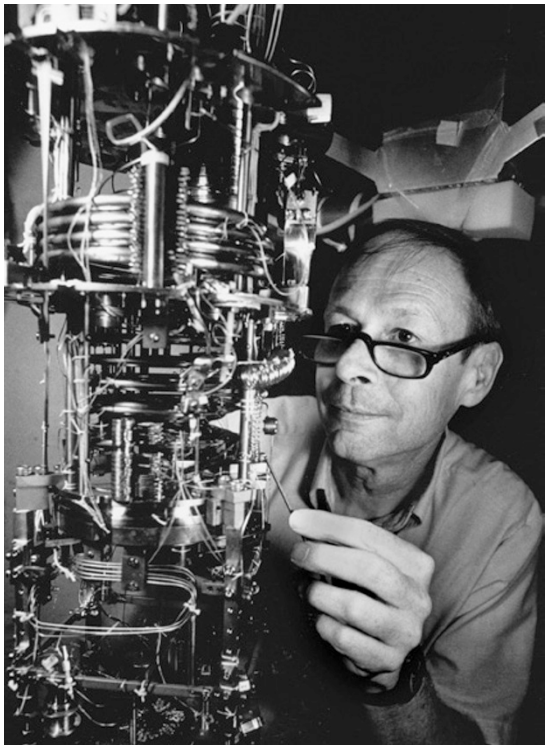
The discovery astounded the physics community, which had all but given up trying to produce the phenomenon in helium-3. In the decades since, the understanding of superfluidity in this isotope has influenced the development of all sorts of superconducting materials, with applications ranging from power grids to nuclear magnetic resonance (NMR) instruments. It has also helped astrophysicists to better understand neutron stars, which have superfluid cores.

Richardson, who died on 19 February, was born in Washington DC in 1937. He grew up in Arlington, Virginia, where his father worked for a local telephone company. As a boy, Richardson was a keen hiker, camper and birdwatcher. He was a member of the Boy Scouts of America and became an Eagle Scout, the highest rank attainable in the programme, in the shortest time allowed.

Richardson received his undergraduate and master's degrees in physics at Virginia Polytechnic Institute in Blacksburg, before spending six months as an officer in the US Army. Before his military service, he had intended to earn a master's in business administration, but he was unimpressed by the management courses he took in the Army and decided to pursue a PhD in physics instead.

In 1960, Richardson began his PhD work in Horst Meyer's laboratory at Duke University in Durham, North Carolina. It was at Duke that Richardson met Betty McCarthy, who was also a graduate student in physics. The two married in 1962; their daughters, Jennifer and Pamela, were born in 1965 and 1966. In Meyer's lab, Richardson learned how to make the equipment needed to investigate how collections of atoms behave at very low temperatures.

In 1966, soon after Richardson received his PhD, he and his young family moved to Ithaca, New York, where he became a postdoctoral researcher for David Lee in the low-temperature group at Cornell University. Richardson joined the Cornell faculty in 1968 as an assistant professor in the physics department, and ultimately became a full professor there. I was one of Lee's graduate students when Richardson became a professor. Often working late into the night, Richardson was always around and willing to give advice, irrespective of whose students we were.



CORNELL UNIVERSITY PHOTOGRAPHY

By the early 1970s, chemists and materials scientists had for decades been probing the behaviour of materials using NMR — in which nuclei in a magnetic field absorb and re-emit electromagnetic radiation at a specific frequency, depending on the properties of the atoms and the strength of the field. But Richardson played a key part in using the technique for extremely low-temperature studies. The question he, Lee and I set out to answer was whether the direction of the nuclear spins in solid helium-3 could spontaneously order at sufficiently low temperatures.

To produce very low temperatures, we compressed liquid helium-3 until it began to solidify, causing the mixture of liquid and solid to cool. We initially (mistakenly) believed that we had produced magnetic order in the solid helium-3, at about 0.002 Kelvins. In fact, we had observed a new physical state: superfluidity in liquid helium-3. The three of us shared the 1996 Nobel Prize in Physics for this discovery.

Richardson won or shared many awards and honours apart from the Nobel prize, including the Sir Francis Simon Memorial Prize in 1976 and the Oliver E. Buckley Condensed Matter Prize in 1981. That year, he was also made a fellow of the American Association for the Advancement of Science. He became a member of the US National Academy of Sciences in 1986.

Richardson was an exceptional citizen, at Cornell University and in the broader physics community. From 1990 to 1996, he served as director of the laboratory of atomic-state physics at Cornell. From 1998 to 2007 he was the university's first vice-provost for research. Richardson was also a member of the US National Science Board, which oversees policy issues related to research and education in science and engineering.

Richardson, or Bob to those who knew him, was competitive, passionate and creative, but also humble and considerate. The great sadness of his life was the tragic death, in 1994, of his younger daughter, Pamela, from heart failure. As a way of dealing with their grief, Bob and Betty, together with Alan Giambattista, a physicist at Cornell, threw themselves into writing a physics textbook entitled *College Physics*.

Bob went out of his way to help and guide young scientists. He was an avid participant in 'penny pitching' — a game, played ritually in the low-temperature lab for many years, that involves tossing pennies at a wall to see whose coin lands closest to it — and he often hosted croquet matches at his home. He once challenged a graduate student who had been training for a marathon to a race up several flights of stairs; the student declined, wanting to keep Bob's health intact. ■

Douglas D. Osheroff *is professor emeritus at Stanford University, Stanford, California 94305, USA.*
e-mail: osheroff@stanford.edu