

OBITUARIES

To notify the community about a colleague's death, subscribers can visit www.physicstoday.org/obituaries, where they can submit obituaries (up to 750 words), comments, and reminiscences. Each month recently posted material will be summarized here, in print. Select online obituaries will later appear in print.

Ronald Crosby Davidson

Pioneering plasma physicist Ronald Crosby Davidson died on 19 May 2016 in Cranbury, New Jersey, due to complications from pneumonia. Long-time editor-in-chief of *Physics of Plasmas*, he also directed the Princeton Plasma Physics Laboratory (PPPL) during a crucial period of its history and was a founding director of the Plasma Fusion Center at MIT.

Ron was born on 3 July 1941 in Norwich, Ontario, Canada. He grew up on a family dairy farm, where by age 11 he was driving a tractor and pitching in wherever needed. Ron learned at an early age how the annual cycle of farm activities comprised seasonal tasks, none of which could be postponed. Many years later, both as lab director and as editor-in-chief, Ron would be struck by similarities between farm tasks and administrative responsibilities. Likewise, his colleagues would be struck by Ron's early-riser habits, incredible energy, and penchant for getting things done as early as weather would permit.

Had he been the oldest child, Ron would have inherited and been expected to run the family farm. Instead, after he finished eighth grade in a one-room schoolhouse, Ron developed a passion for physics and mathematics in high school that drove his monumental impact in plasma physics.

Ron earned a BSc degree in physics from McMaster University in 1963. He received his PhD in astrophysical sciences from Princeton University in 1966 under the advice of Edward Frieman. After an exceptionally distinguished career at several institutions, Ron arrived at MIT in 1978 with the challenge of organizing and expanding its plasma-science research, especially the Alcator tokamak program. He established the MIT Plasma Fusion Center with a broad scientific agenda that included toroidal and mirror field confinement experiments, theory and computation, magnet engineering, and particle-beam research. Ron returned to Princeton in 1991 to serve as a professor of astrophysical sciences and, until 1996, as director of PPPL.



Ronald Crosby Davidson

Ron made fundamental theoretical contributions to several areas of pure and applied plasma physics, including non-neutral plasmas, nonlinear effects and anomalous transport, kinetic equilibrium and stability properties, propagation of intense charged-particle beams in high-energy accelerators, and coherent radiation generation by relativistic electrons. He is the author of more than 450 journal articles and several books. His 1972 book, *Methods in Nonlinear Plasma Theory* (Academic Press), served as a key early textbook on plasma physics. He also is known for his advanced research monographs, including *Theory of Nonneutral Plasmas* (Benjamin Press, 1974), *Physics of Nonneutral Plasmas* (Addison-Wesley, 1990), and, with one of us (Qin), *Physics of Intense Charged Particle Beams in High-Energy Accelerators* (World Scientific, 2001).

As director of PPPL, Ron oversaw the achievements of the Tokamak Fusion Test Reactor (TFTR) during its deuterium-tritium campaign. In December 1993, for the first time in the history of tokamak plasma devices, a reactor fuel mix of 50% deuterium and 50% tritium was used. Introducing that fuel mix into the TFTR released about 6 million watts of fusion power. In November 1994 the TFTR achieved 10.7 million watts of fusion power for one second, enough to momentarily power 2000 to 3000 homes.

Ron gave years of distinguished service to the physics community as the chair of two divisions—plasma physics and physics of beams—of the American Physical Society and as editor-in-chief for *Physics of Plasmas* from 1991 to 2015. One of the longest-serving editors at the American Institute of Physics (which publishes *PHYSICS TODAY*), Ron was an inspirational leader who conducted his editorial service with humble kindness. Shortly after becoming editor of *Physics of Fluids B*, he established *Physics of Plasmas* as its successor. Thereafter, his steady leadership, research excellence, and welcoming embrace of the international community of plasma physicists led to the expansion of *Physics of Plasmas* and its becoming the most highly cited journal in its field.

Among his many recognitions and honors, Ron received the Kaul Foundation Award for Excellence in 1993, the IEEE Particle Accelerator Science and Technology Award in 2005, the American Physical Society's James Clerk Maxwell Prize in Plasma Physics in 2008, and the Fusion Power Associates Distinguished Career Award in 2014.

To his students and young colleagues, Ron was a gentle, exemplary mentor with high standards for scientific quality, especially in the implementation of research projects. His moral compass was so clear that the rest of us would lean over his shoulder at critical moments to see which way it was pointing. As a scientist and friend, Ron will be greatly missed.

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Hefei

Robert Goldston

Princeton Plasma Physics Laboratory
Princeton, New Jersey

Jonathan Wurtele

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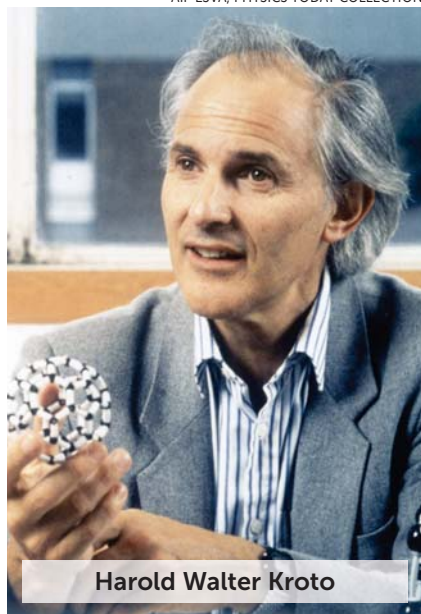
Jeffrey Freidberg

Massachusetts Institute of Technology
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Harold Walter Kroto

Harold Walter Kroto was an exceptional human being. Not only was he a groundbreaking scientist whose work earned him a share of the 1996



Harold Walter Kroto

Nobel Prize in Chemistry, he was also a pacifist, humanist, and excellent communicator who had lasting influence on younger generations.

Harry was born in Wisbech, England, on 7 October 1939; his parents had emigrated from Germany in 1937. His father started a balloon-making factory, and Harry frequently helped out. He worked with the machinery (physics), mixed latex dyes (chemistry), and helped out wherever he was needed, including replacing workers on the production line. Throughout his career as a research scientist, he used the problem-solving skills he had developed in the factory.

Harry received his BSc in 1961 and PhD in 1964, both in chemistry, from the University of Sheffield. There he also became interested in sports, but art, as he used to say, was his passion. He became attracted to quantum mechanics, and his PhD work on the spectroscopy of free radicals was supervised by Richard Dixon. Harry later took a postdoctoral position at the National Research Council Canada with Donald Ramsay, who introduced him to an atmosphere of freedom in research and offered the best spectroscopy equipment in the world. There Harry was able to combine his knowledge of quantum physics, interstellar spectroscopy, and chemistry. He later transmitted that research freedom to his own students and postdocs. After a year he moved to the US for another postdoctoral position at Bell Labs.

In 1966 Harry was offered a position

at the University of Sussex by John Murrell, a former teacher of his at Sheffield. He accepted it, despite a big decrease in salary.

Harry submitted three proposals to the UK's Science and Engineering Research Council before it awarded him a grant to buy a new spectrometer. His use of it to study chains of HC_5N marked the beginning of Sussex's fullerene research program.

Buckminsterfullerene—also known as C_{60} and buckyball—was discovered in 1985, after Harry and Robert Curl (Rice University) convinced Richard Smalley (also at Rice) to carry out a laser-vaporization experiment with graphite as a target: The idea was to simulate the conditions of exploding giant stars and confirm the possible formation of long carbon chains. Instead of carbon chains, the team unexpectedly found stable clusters with 60 carbon atoms (C_{60}) that were thought to be cage molecules. Harry proposed the name because he was inspired by American architect Buckminster Fuller, well known for his giant geodesic domes. In fact, earlier in his career Harry considered asking Fuller for a job since he was interested in design and architecture.

From 1985 to 1990, Harry gave numerous lectures related to the discovery of C_{60} , proposed new fullerene geometries, discussed the possibility of concentric and spiral giant fullerenes in certain carbon soot, and predicted that diffuse interstellar bands were due to the presence of C_{60}^+ . That time was the beginning of carbon nanoscience—nanotubes, graphene, and fullerites were not yet on the scene.

Without a doubt, Harry influenced the field of the physics, chemistry, and materials science of nanostructures. After the 1990 breakthrough in which Wolfgang Krätschmer, Lowell Lamb, Konstantinos Fostiropoulos, and Donald Huffman obtained C_{60} crystals, an incredible amount of fullerene-related papers appeared in physics, chemistry, and materials-science journals.

On 9 October 1996, Curl, Smalley, and Harry were awarded the Nobel Prize in Chemistry for their discovery of fullerenes. Despite receiving it, Harry continued to be the same approachable and charismatic person. And he always acknowledged in his lectures the key role that students James Heath, Sean

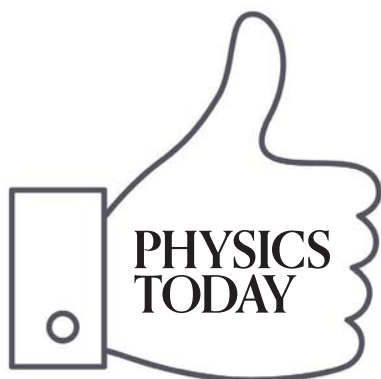
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O'Brien, and Yuan Liu played in the C_{60} discovery.

As a Nobel laureate, Harry intensified his efforts to help the public better understand science by strengthening the Vega Science Trust. The mission of the organization, which Harry founded in 1995 with Patrick Reams, was to use scientists to communicate to the general public the importance of scientific discoveries.

As part of his outreach efforts, Harry organized numerous science workshops for children. They loved to hear Harry talk about how the carbon atoms in our bodies might have been in C_{60} molecules generated in outer space—so that would make us all aliens.

As a colleague, Harry was rigorous in his search to fully understand research results, and he always asked for more explanation supported by experimental evidence; he did not like loose ends. His comments and criticisms on draft manuscripts were precise, but in the end, the papers were bulletproof. He did not like to rush to get an article published. Besides C_{60} , he contributed greatly to phosphalkene chemistry, spectroscopy of different molecules, and carbon nanotubes.

Harry was adept at collaborating with researchers from different fields, and he transmitted to students and colleagues the importance of multidisciplinary research. It is not a coincidence that his group at Sussex included students from different scientific backgrounds and collaborated with scientists from other countries.

Harry enjoyed graphic design so much that he thought about pursuing it as a career if things didn't work out in the scientific arena. At his house in Lewes, he had a huge collection of art books. He also had a strong interest in architecture, including geodesic domes at the macroscale. Once when visiting Mexico, he was invited by Mexican architect Juan José Díaz Infante Núñez to his home to give a talk on art and science. He delivered it inside a mirror-filled geodesic dome that was part of the architect's house. Harry and Margaret, his wife, were amazed by the unique experience of his giving a talk inside a fullerene-like structure.

In July 2015 the Royal Society of Chemistry and the Royal Society organized a symposium in London to cele-

brate the 30th anniversary of the discovery of C_{60} . During the workshop, Harry was told by John Maier that Maier's group in Switzerland had found that the diffuse interstellar spectral bands observed a long time ago but not then identified were unequivocally due to C_{60}^+ , a result that Harry predicted in 1987.

When talking about Harry, one can't portray him as just a successful scientist and not mention his gracious demeanor and warm personality. He touched many people of different interests, backgrounds, and nationalities, and they will never forget him.

Humberto Terrones

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Carolyn Marina Van Vliet
27 December 1929 – 15 July 2016

Young B. Kim
23 October 1922 – 7 July 2016

James N. Lloyd
20 October 1932 – 8 June 2016

Arthur J. Freeman
6 February 1930 – 7 June 2016

George Rathjens
25 June 1925 – 27 May 2016

Paul R. Yoder Jr
6 February 1927 – 26 May 2016

Moo-Young Han
1934 – 15 May 2016

Jack G. Dodd Jr
19 June 1926 – 23 April 2016

David J. C. MacKay
22 April 1967 – 14 April 2016

Dale A. Zych
8 April 1938 – 5 April 2016

Marshall Fixman
21 September 1930 – 27 February 2016

Hans Kleinpoppen
30 September 1928 – 12 February 2016

Virginia R. Brown
11 March 1934 – 8 February 2016

Branka Marie Ladanyi
7 September 1947 – 30 January 2016

Robert John Soulen Jr
16 July 1940 – 19 November 2015