John Bahcall 1935–2005

John N Bahcall, a renowned leader in the fields of astrophysics and neutrino physics, passed away on 17 August 2005 from a rare blood disorder. He was 70 years old. Bahcall was a pioneer in the field of solar-neutrino studies, calculating neutrino fluxes and detection reactions that led to the original measurements by his long-time colleague Ray Davis and other subsequent measurements. His perseverance in resolving the flux deficit known as the "solar-neutrino problem" motivated the field and significantly advanced particle physics and solar physics.

Bahcall was born in Shreveport, Louisiana, and educated at Louisiana State University, the University of California at Berkeley (AB, 1956), the University of Chicago (MS, 1957) and Harvard University (PhD, 1961). He was a research fellow at Indiana University from 1960 to 1962 before joining the faculty at Caltech. He became a member of the Institute for Advanced Study in Princeton in 1968, and was named Richard Black Professor of Natural Sciences in 1997.

Bahcall had a very strong influence on the development of solar-neutrino measurements and was regarded as the premier theoretical physicist in the detailed understanding of the solar interior. This work began when he was at Caltech in the 1960s. His early papers on solar-neutrino fluxes and the sensitivity for neutrino detection with chlorine led to the development of the Homestake detector and the first clear observations of solar neutrinos, for which Ray Davis received the Nobel Prize in 2002. For more than 30 years, Bahcall and his collaborators refined their theories of the Sun, seeking to understand the flux deficit observed in the chlorine experiment and in subsequent measurements by Kamiokande (led by Masatoshi Koshiba, who shared the Nobel Prize with Davis), SAGE, GALEX/GNO, Super-Kamiokande and the Sudbury Neutrino Observatory (SNO). Although the solar models continued to provide remarkable agreement with all known solar properties, including very detailed measurements of sound speed profile through helioseismology, the neutrino deficit remained.

Bahcall and his collaborators also explored particle-physics processes beyond the Standard Model that eventually provided the basis for a clear explanation of the deficit through direct measurements of neutrino flavour-change by SNO. These measurements also confirmed the accuracy of the solar-model calculations they made. Bahcall's perseverance, careful development of theoretical calculations for the Sun, encouragement and support of experimental initiatives, and his broad consideration of all physics possibilities marked him as an active leader throughout his long career. He deserves tremendous credit for the significant advances in neutrino and solar physics that have been made through solar-neutrino studies.

Bahcall's work in astrophysics includes many major contributions, such as the standard model for a massive black hole surrounded by a cluster of stars – the Bahcall–Wolf model – and the widely quoted model for our galaxy, the Bahcall–Soneira model. In the 1960s he and Edwin Salpeter suggested the use of quasar light for the study of intervening regions of space, studies that he pursued himself with the Hubble Space Telescope. His collaboration with Eli Waxman set limits for the fluxes of high-energy cosmic neutrinos now being sought by neutrino telescopes.

In addition to producing an extensive body of published work, involving more than 600 scientific and technical papers, Bahcall was an influential force in the development of astrophysics. He was noted as an exceptional mentor of young scientists, particularly during postdoctoral experience with his group at the Institute for Advanced Study. He was a leader in the development of the Hubble Space Telescope and the Space Science Institute, and helped set directions for neutrino astrophysics through his strong support of new detectors. He was president of the American Astronomical Association and led the team that produced the 1990 National Research Council Bahcall Report, setting scientific and instrumental priorities for astrophysics in the US for a decade. At the time of his final illness, he was president-elect of the American Physical Society.

Bahcall received numerous awards and prizes including the 1998 National Medal of Science; the Hans Bethe Prize of the American Physical Society; the Dan David Prize of Israel; the Gold Medal of the Royal Astronomical Society; the Fermi Award (with Raymond Davis); and the Benjamin Franklin Medal in Physics (with Raymond Davis and Masatoshi Koshiba). He received honorary doctorates from the universities of Pennsylvania, Chicago, Notre Dame and Milano, and the Hebrew University of Jerusalem.

Bahcall and his wife Neta, a professor of astrophysics at Princeton, collaborated on more than 30 scientific papers. They were the only married couple in the National Academy of Sciences of the United States. They have three children, all scientists.

Art McDonald, Queen's University, Kingston, Ontario, Jeremiah Ostriker, Princeton University, and Alexei Smirnov, ICTP, Trieste.