David Pines FREE

Special Collection: Print Obituaries

Kevin Bedell; David Campbell; Robert Laughlin

Physics Today **72** (1), 63 (2019);
https://doi.org/10.1063/PT.3.4119

David Pines

David Pines, a preeminent theoretical physicist and a convener of numerous academic efforts, died of pancreatic cancer at his home in Urbana, Illinois, on 3 May 2018. Over his long and illustrious career, David made major contributions to condensed-matter physics, nuclear physics, and astrophysics and created lasting national and international institutions.

Born in Kansas City, Missouri, on 8 June 1924, David received a bachelor's degree from the University of California, Berkeley (UCB), in 1944. After two years in the US Navy, David began graduate studies at UCB and continued them at Princeton University. He earned his doctoral degree from Princeton in 1951 under David Bohm; his thesis was titled "The role of plasma oscillations in electron interactions." During the next three years, David and Bohm published three seminal papers related to those collective oscillations and developed the random-phase approximation, which remains a key method of many-body theory. It also provided David's first glimpse into the emergence of collective behavior, which could not readily be deduced from the behavior of individual components. Emergence would remain a central concept in all of David's work.

From 1950 to 1952, David was an instructor at the University of Pennsylvania. He then joined John Bardeen at the University of Illinois at Urbana-Champaign (UIUC) as a research assistant professor. In 1955, together with Bardeen, David published a key article on the electron–phonon interaction in metals and showed that phonon-retardation effects could induce an attractive interaction between electrons. That crucial insight underlies the theory of superconductivity that Bardeen, Leon Cooper, and J. Robert Schrieffer proposed in 1957 and that earned them the Nobel Prize in Physics in 1972. David's 1958 paper with Aage Bohr and Ben Mottelson pointed out a possible analogy between the excitation spectra of nuclei and of superconductors; that paper played a similar foundational role in the work of Bohr, Mottelson, and James Rainwater on the connection between collective and particle motion in nuclei, for which they were awarded the 1975 Nobel Prize in Physics.

David was an assistant professor at Princeton from 1955 to 1958 and a member of the Institute for Advanced Study in Princeton from 1958 to 1959. David then returned to UIUC as a professor of physics and electrical engineering; he remained in that role until his retirement in 1995. During that 36-year span, David made important contributions to the theory of quantum fluids, including liquid helium-3 and helium-4 with Charles Aldrich III, and to the theory of rotons in ^{4}He with Alfred Zawadowski and one of us (Bedell). He also studied superfluidity in neutron stars; in a series of papers with several collaborators, he developed a model for the "glitches" observed in emissions from pulsars.

PIERS COLEMAN

David Pines

The discovery of high-temperature superconductivity in 1986 provided David with a new challenge ideally suited to his background. Inspired by his familiarity with paramagnons in ^{3}He, David advocated strongly for a mechanism based on spin fluctuations and was gratified when the expected *d*-wave pairing was observed in the mid 1990s. Despite his tireless advocacy, the full theory of high-T_c superconductors remains elusive.

In retirement, David remained vigorously involved in research and spent time at many institutions, including Los Alamos National Laboratory, UC Davis, the KTH Royal Institute of Technology in Stockholm, and Trinity College Cambridge. In addition to continuing his work on high-T_c superconductivity, he applied principles of emergence to complex adaptive systems, including biological systems and soft matter. In more recent years, David created several projects in science education, including the international Think Like a Scientist initiative, which aims to bring the approaches of science to students in middle schools.

David's enthusiasm for science was matched by his passion for creating and supporting institutions to facilitate collaboration. He led the Center for Advanced Study at UIUC from 1967 to 1970, served as vice president of the Aspen Center for Physics from 1968 to 1972, and cofounded the Santa Fe Institute in 1984 and the Institute for Complex Adaptive Matter in 1999. Internationally, David was a trailblazer in spanning the divide between the scientific communities of the US and the Soviet Union. Following the collapse of the Soviet Union in 1991, David was instrumental in helping several of its physicists find new careers in the US.

David's many honors include the 1985 Dirac Medal for the Advancement of Theoretical Physics from the University of New South Wales, the 1985 Eugene Feenberg Memorial Medal for many-body theory, the American Association of Physics Teachers' 2013 John David Jackson Award for Excellence in Graduate Physics Education, and the 2016 Julius Edgar Lilienfeld Prize of the American Physical Society.

David Pines was indefatigably enthusiastic and persistent in pursuing his own science and in creating institutions to foster the science of others. Like many of our colleagues, we share wonderful memories of scientific and personal interactions with him. His powerful and inspiring presence will be missed, but his legacy is vast and permanent.

Kevin Bedell
Boston College
Chestnut Hill, Massachusetts
David Campbell
Boston University
Boston, Massachusetts
Robert Laughlin
Stanford University
Stanford, California PT