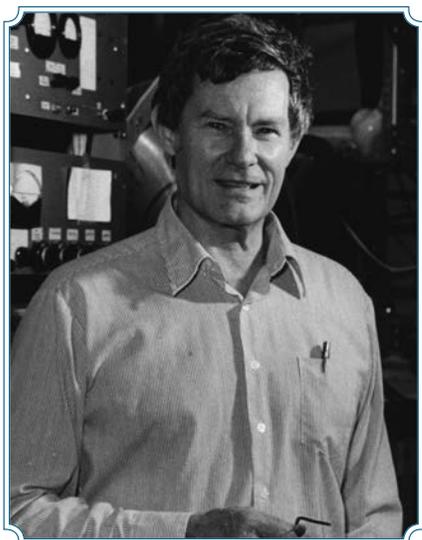


## In Remembrance

### John King, professor emeritus of physics, dies at 88

Innovative researcher and educator was a champion of attacking science problems with “ferocious vigor.”

by Teresa Lynne Hill



Professor emeritus John G. King '50, PhD '53, an experimental physicist, transformative physics educator, and leader of the MIT Molecular Beams Laboratory in the Research Laboratory of Electronics for 42 years, died on June 15, 2014, at his summer house in Wellfleet, Mass. A longtime resident of Cambridge, King was 88.

“John was an inspiring teacher and experimentalist. His educational passion was creating hands-on experiments built from ordinary parts you can find at any hardware store, what he lovingly called ‘mulch,’” said MIT senior lecturer in physics, and former King student, Peter Dourmashkin '76 (physics), '78 (math), PhD '84. “He was MITx before MITx.”

King was born in London and educated in France, Switzerland, and the United States. He came to MIT as an undergraduate in 1943 and completed his undergraduate studies in physics following war service for the U.S. Army, U.S. Navy, and the Harvard Underwater Sound Lab. He joined the MIT physics faculty in 1953. King was named the Francis L. Friedman Professor of Physics in 1974 and retired from MIT in 1996.

King was renowned for his null experiments—those designed to test fundamental principles. He helped develop the atomic clock and invented the molecular microscope. King’s best-known experiment, still found on the first page

Photo courtesy of the MIT News Office

of most electricity and magnetism textbooks, is the measurement of the charge magnitude equality of the electron and the proton, and the neutrality of the neutron to a  $10^{-20}$  of an electron charge. King also conceived an imaginative experiment, prompted by cosmological ideas, to set a hard limit on the possibility that matter, over cosmological time, begets new matter, a version of what was once called the steady state cosmology.

### Building atomic and molecular beam research

Professor of physics emeritus Rainer Weiss '55, PhD '62 was a colleague of King throughout his student and faculty years at MIT and considers him to be “one of the most creative and imaginative experimental physicists of his generation.” Both physicists were students of Jerrold Zacharias, who began the Molecular Beam Laboratory at MIT shortly after World War II. Molecular beam experiments measure the properties of individual atoms in a vacuum unperturbed by interactions with other molecules. The technique provides precise and universally reproducible values for the energy levels and other parameters of these quantized systems. King began his work in molecular beams by pioneering new methods to measure the charge and current distributions in the nuclei of the halogens. He discovered the magnetic octupole moment of the common isotope of iodine.

During his years as director and principal investigator of the Molecular Beam Laboratory, King transformed the research conducted there. It branched into molecular beam techniques applied to collective body physics, cosmology, and biophysics. More than 100 undergraduate and 25 doctoral students obtained their degrees working on these topics during King’s tenure at the laboratory.

### Reinventing physics education

Dissatisfied with the lab exercises used in mid-century physics pedagogy, King worked tirelessly on innovative methods that stressed hands-on learning and independent thinking. In 1966, he initiated the Project Lab, in which students developed their own open-ended research projects. His belief that anyone could “find something interesting to study about any mundane effect” reflects the independent spirit of King’s own early and eclectic science education. He told his students that “the best way to understand your apparatus is to build it.”

As an advisor, King quickly became a project participant. Charles H. Holbrow, professor of physics emeritus at Colgate University and currently a lecturer at MIT, recalled that King had “the wonderful gift of seeing physics in everyday phenomena and turning these into research projects.” Some 2,000 MIT undergraduates experienced Project Lab.

A King student from his MIT sophomore year through graduate school, Samuel A. Cohen, director of the Program in Plasma Science and Technology at Princeton

University, learned how to operate a drill press and to build his own electron multipliers. At the same time, he was being influenced by King's ideas. He says, "John's mind kept jumping decades ahead, from atomic beams to superfluid He<sub>3</sub> to molecular microscopy—always decades ahead."

With other educators in the late 1950s and '60s, King worked on the revitalization of high school physics, following the startling realization on the part of Zacharias that "while students had taken physics, they didn't understand anything." When the 1957 launching of Sputnik spurred a nation-wide alarm and allocation of money to improve science teaching, King became deeply involved. In cooperation with the influential Physical Science Study Committee (PSSC), he produced—and acted in—eight physics movies, including "Times and Clocks," "Interference with Photons," "Size of Atoms from an Atomic Beam Experiment," and "Velocity of Atoms." One of the films featured King demonstrating a principle of physics by driving one of the Bugatti automobiles he had meticulously restored down the Massachusetts Turnpike at high speed.

### A life of invention

Family, friends and colleagues paint a portrait of an energetic, curious and engaging man who applied these characteristics equally to his intellectual, professional and personal lives. King's wife, Jane Williams, recalls him as "interesting, imaginative, ingenious and lots of fun." In addition to his enthusiasm for physics and the value of science as the basis for understanding the world around us, she says, he was throughout his life "passionate about classical music, poetry and any kind of dictionary. Since his early years were spent in France, he cared about things French, including French wines."

King was the recipient of many honors and awards for contributions to physics and physics education. These include the Alfred P. Sloan Award (1956), the AAPT Robert Millikan Medal (1965), the E. Harris Harbison Award (1971), and the Oersted Medal (2000), the most prestigious award of the American Association of Physics Teachers. His numerous publications include co-authorship with Paul Gluck of Jerusalem of *Physics Project Labs* (Oxford University Press), to be published in fall 2014.

In addition to his wife, King is survived by a daughter, Martha, and sons Andrew, James, Charles, David, Benjamin, and Matthew; granddaughters Sara, Katy, and Lily; stepchildren Cynthia, David, Catherine, and Nicholas; and eight stepgrandchildren. His oldest son Alan predeceased him.

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## Senior research scientist emeritus Alan Lazarus dies at 82

Career at MIT spanned more than 50 years,  
focusing on space plasma and the solar wind.

by John Belcher  
with Marianne Lazarus and Julia Lazarus

**A**lan Jay Lazarus, senior research scientist emeritus at MIT, a gentle man, respectful of all and respected by all who knew him, died peacefully in his home in Lexington, Mass., on March 13, 2014. He was 82.

Lazarus was born in San Francisco on October 24, 1931. His early education in California schools, completed with a year at Phillips Andover Academy, developed in him a love for learning, especially science. He had summer jobs at Los Alamos and Oak Ridge National Labs, while earning degrees at the Massachusetts Institute of Technology ('53, physics) and Stanford University (PhD '58, high-energy physics, under the direction of W. K. H. Panofsky). He did post-graduate work at the Rand Corporation.

Lazarus' career at MIT, begun in 1959, spanned more than 50 years. He joined space research pioneers Bruno Rossi and Herbert Bridge to study space physics, focusing particularly on space plasma and the solar wind. At MIT's Center for Space Research (now the Kavli Institute for Astrophysics and Space Research), Lazarus helped develop instruments for more than 20 spacecraft missions to learn about the solar wind, including the plasma instruments on board Voyagers 1 and 2, launched in 1977, which are the first spacecraft to travel beyond the edge of our solar system. Instruments he developed continue to provide measurements of the solar wind plasma that buffets Earth, and of the distant boundary between solar plasma and the interstellar medium.

Lazarus was the principal investigator for a solar wind experiment on SOLRAD 11. He was also a co-investigator for a solar wind plasma experiment

utilizing Faraday cup sensors on Explorers 10, 18, 33, and 35, which studied Earth's magnetosphere; the Mariner 4, Mariner 5 and Mariner 10 missions to Venus and Mars; Pioneers 6 and 7, and Voyagers 1 and 2, which explored the outer solar system; the Imp-7, Imp-8 and Wind spacecraft focused on solar wind near Earth; the Orbiting Geophysical Observatories 1 and 3, which studied Earth's magnetosphere; and the Giotto probe to Halley's comet. He was the lead

Lazarus' DSCOVR Faraday Cup is scheduled to fly in early 2015 as a real-time beacon for NOAA space weather forecasting. ... [T]his instrument will be a prototype for a Faraday Cup on Solar Probe, scheduled for launch in 2018.

or co-author on more than 200 scientific papers. Lazarus' DSCOVR Faraday Cup is scheduled to fly in early 2015 as a real-time beacon for NOAA space weather forecasting. Because it will be sun-pointed and make fast measurements, this instrument will be a prototype for a Faraday Cup on Solar Probe, on which he was a co-investigator, that is scheduled for launch in 2018.

In addition to his research position, Lazarus was a senior lecturer in MIT's department of physics. He cared deeply about his students and worked to bring delight to their learning experiences in the first- and second-year physics courses taken by all MIT students (8.01 and 8.02), and by working to develop innovative teaching methods. He ran a modern laboratory course for physics majors that introduced students to techniques of classical and modern physics, and served as co-director of MIT's Integrated Studies Program. Always ready to share his experience and love of MIT, Lazarus was a caring and devoted

faculty advisor to many students over the years. In 1963 he was the first recipient of MIT's Everett Moore Baker Award for Outstanding Undergraduate Teaching. From 1977-1980 he was MIT's Associate Dean of Students in Charge of Freshman Advising, where he was instrumental in the creation of the Undergraduate Academic Support Office. In 1998 he received the physics department's William W. Buechner Faculty Award for Teaching.

Lazarus was a beloved colleague to his MIT compatriots, to the many graduate students and senior thesis students he mentored, and to the wider space physics community, nationally and internationally. "I really can't think of another person

in our field who would so frequently bring a smile to people's faces as they remembered a time he helped them out, often as a student or postdoc just getting started, and often without asking or expecting anything in return," says University of Michigan professor Justin Kasper, formerly of the Kavli Institute. "He really would help anyone who asked."

Lexington, Mass., was Lazarus' home for 42 years. He was an active member of the community, serving as an elected Town Meeting member for 30 years and on various town boards and committees, from Appropriations to Hanscom Field Advisory. He was chair of the group that founded LexMedia, the town television station. He was also deeply interested in the town schools, especially in their teaching of science, and he served on the school system's Science Advisory Council and as a judge for the high school's science fairs.

Lazarus enjoyed swimming, sailing and the rich atmosphere of MIT's collegial community. He loved music, art and culture, good food and drink, and the company of friends and family. He is survived by his wife of 43 years, Marianne; his daughter, Julia, of Providence, R.I.; his sister and brother-in-law Louise and Pieter de Vries of San Rafael, Calif.; a nephew; three nieces; and their six children. He will be missed by his many friends and colleagues, who gathered in Lexington on April 12 in celebration of his life.

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