

In Remembrance



Kerson Huang, professor emeritus of physics, dies at 88

Theoretical physicist was also known
for his translations of Chinese texts.

by Scott Morley, Laboratory for Nuclear Science

MIT Professor Emeritus Kerson Huang, who was well known for his contributions to the field of statistical physics, passed away on September 1, 2016, at the age of 88.

Born March 15, 1928, in Nanning, Kwangsi, China, Huang spent his youth primarily in Manila, The Philippines. He received his BS in physics in 1950 and his PhD in 1953, both from MIT. He was one of the most prominent advisees of Austrian-American theoretical physicist Victor Weisskopf. Huang served as an instructor at MIT from 1953 to 1955 before spending two years as a fellow at the Institute for Advanced Study. He returned to MIT in 1957 as an assistant professor in physics and was promoted to associate professor in 1961 and to professor in 1966. He was part of the first faculty of the Center for Theoretical Physics (CTP) when it was inaugurated in 1968, and was also a researcher in the Laboratory for Nuclear Science.

Together with C. N. Yang, T. D. Lee and others, Huang contributed to the development of the consistent many-body description of interactions of identical particles such as helium atoms. With Steven Weinberg, Huang showed that the spectrum of strongly interacting particles is so rich that it implies that there is an ultimate temperature above which the description in terms of hadrons breaks down. Together with T. D. Lee and C. N. Yang, and separately with Francis Low, Huang wrote important papers on the nature of the weak interaction, especially the way in which then newly-discovered parity violation could be observed experimentally. His books, *Introduction to Statistical Physics* and *Statistical Physics*, are widely used throughout the world as fundamental texts in the field.

In addition to his many physics accomplishments, Huang was a broadly engaged intellectual who translated Chinese poetry into English and *vice versa*.

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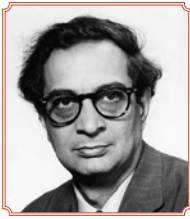
His translations include *I Ching, the Oracle* and *I Ching* (with Rosemary Huang). He also published several books of his own poetry in Chinese.

After Huang became a professor emeritus in 1999, he remained with the CTP until 2005 before retiring to Florida. In recent years, he had been a visiting professor at Nanyang Technical University in Singapore.

Huang was a fellow of both the American Physical Society and the American Academy of Arts and Letters. During his career, he was the recipient of fellowships from the Alfred P. Sloan, John Simon Guggenheim, and Fulbright Foundations.

He is survived by his daughter, Kathryn Camille Huang, and by his former wife, Rosemary Huang. Prior to entering hospice, Huang most recently resided in Wakefield, Massachusetts.

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Professor Emeritus Ali Javan, inventor of the first gas laser, dies at 89

Longtime MIT professor was a trailblazer in the fields of laser technology and quantum electronics.

by Chuck Leddy for the Department of Physics

MIT Professor Emeritus Ali Javan, the first Francis Wright Davis Professor of Physics, who was a trailblazer in the fields of laser technology and quantum electronics, died of natural causes on September 12, 2016, at the age of 89.

In 1960, while working at Bell Laboratories, Javan invented the world's first gas laser. The technology would be applied to telecommunications, internet data transmission, holography, bar-code scanners, medical devices, and more.

Javan came to MIT as an associate professor of physics in 1961, and founded the nation's first large-scale research center in laser technology. He also developed the first method for accurately measuring the speed of light and launched the field of high-resolution laser spectroscopy.

"In the 1960s and 1970s, Professor Javan's laser group at MIT was a hotbed of innovation and advances in amazingly broad areas in laser physics," said Irving P. Herman PhD '77, who studied with Javan and is currently the Edwin Howard Armstrong Professor of Applied Physics at Columbia University. "His group was key to understanding the fundamentals of the interactions of laser with matter, and in implementing them. He will be remembered by his many students and colleagues as a brilliant man, a pioneer, an inspiring man, and a kind and dear man."

From Tehran to New York City

Ali Javan was born in Tehran, Iran, in 1926, and came to the United States in 1949, where he studied and worked at Columbia University with Nobel prize-winning physicist Charles H. Townes. Having received neither a bachelor's nor a master's degree, Javan earned his PhD in physics at Columbia in 1954, with Townes serving as his thesis advisor.

While at Columbia, Javan also studied music, continuing a lifelong passion for the arts that he often connected to his groundbreaking scientific work. “Physics and music—you find the same spirit in both of them,” Javan once wrote. “It just manifests itself in different directions. There’s something immensely beautiful about physics, even though it’s very difficult. Take the atom—a single atom is absolutely gorgeous. Ask anybody in physics.”

Making history: The first gas laser

In 1958, Javan developed the working principle of the first gas discharge helium neon laser. In the following two years, he worked at Bell Laboratories to build it, along with colleague William Bennett.

“The first laser, the ruby laser by Ted Maiman, used optical pumping to create the population inversion necessary to achieve lasing,” Herman notes. “At the time this was difficult and not applicable to all systems. Javan was able to see how a population inversion can be created in a gas discharge by selective, resonant energy transfer. This was key to his invention of the first gas laser, the He-Ne laser, which was also the first continuous wave laser.”

Javan’s breakthrough came on December 12, 1960, when for the first time in history, a continuous laser light beam emanated from a gas laser apparatus. As Javan later described it, he “drove the design into its self-sustained oscillation mode. Emanating at its output, for this very first-time ever, a continuous-wave (CW), collimated light beam, at a color purity as it proved to the limits that the law of nature will permit.”

The next day, Javan and his Bell Labs colleagues used the laser light beam to place a telephone call, the first time in history that a laser beam had been used to transmit a telephone conversation.

Joining the MIT community

Javan came to MIT in 1961 and would spend the next four decades working to drive advances in atomic, molecular and optical physics. From 1978 to 1996, he was the first Francis Wright Davis Professor of Physics, and was emeritus professor of physics from 1996 until his death.

Javan was the recipient of numerous awards. In 1993, he was presented the Albert Einstein World Medal of Science in recognition for “his more than 30 years of research into the physics of lasers.” In 2006, he was inducted into the National Inventors Hall of Fame. Javan’s original 1960 helium-neon laser device is currently on display at the Smithsonian Institution’s National Museum of American History.

A passionate, inspiring teacher

Javan was a passionate teacher who developed lifelong bonds with generations of students, not only sharing his passion for science but for music and the arts. He wanted students to be well-rounded individuals conversant in more than

just physics. As Javan's former student and colleague Said Nazemi PhD '81, who helped him found Laser Science, Inc., recalls, "I spent a lot of personal time with him and his family, and knew him not just as a great teacher but as someone with a big sense of humor who also loved classical music and gourmet cooking."

Another of Javan's associates was Ramachandra Dasari, the associate director of MIT's George R. Harrison Spectrography Lab. Javan helped shape his entire career, says Dasari: "I became a new person in science because Javan taught me about lasers." Dasari fondly remembers Javan's enthusiastic, hands-on approach to pedagogy. "He used to come into the lab often and see what his students were doing with their experiments. He liked to prod and touch things, which made students so nervous, but he just couldn't help himself."

Javan's daughter Maia recalls, "He loved teaching his postdocs, and treated them like part of our family. They'd often have dinner over our house, and then go back to work at the lab. Sharing food and laughter, and enjoying life, that was so important to him."

Ali Javan is survived by his daughters Maia and Lila, his grandchildren Valerik and Riva Perelman, and the mother of his children, Marjorie Javan.

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Anthony P. French, Professor Emeritus of Physics, dies at 96

by Sandi Miller for the Department of Physics

Anthony “Tony” Philip French, MIT professor emeritus of physics and a notable leader in physics education, died on February 3, 2017. He was 96 years old.

French was born November 20, 1920, in Brighton, England. The son of a printer, French earned a scholarship to Sydney Sussex College at Cambridge University, following an early interest in science, especially classical mechanics. He was particularly interested in lectures by Egon Bretscher, a Swiss physicist at Cambridge, who steered French toward nuclear physics.

After receiving a BA in physics in 1942, French was recruited by Bretscher into the Tube Alloys Project, Britain’s code name for its atomic bomb research. French’s job was helping Bretscher measure fast neutron cross-sections, information needed to design a bomb. In 1944, the British effort was merged with the American Manhattan Project, and Tony was sent with the British mission to Los Alamos. “He was 23, barely educated in physics, and suddenly removed from grim wartime Britain to a land of sunshine where you could have oranges and eggs and set down in the mountains of New Mexico with some of the best and most famous physicists in the world,” says Professor Charles H. Holbrow, Colgate University emeritus professor of physics. “It was exciting.”

French worked in a group led by physicist Edward Teller, who wanted to develop what would eventually become the hydrogen bomb, the so-called “Super.” Bretscher and Tony French worked in Teller’s small group, and French measured reactions of light nuclei such as $d + d \rightarrow p + 3H$ and $d + 3H \rightarrow n + 4He$.

After the war ended, French married Naomi Livesay, a mathematician from Montana who had worked in Richard Feynman’s computation group at Los Alamos.

In 1946, they moved to Cambridge University in England, where, as a fellow and director of studies in Natural Sciences at Pembroke College, French became a faculty member and earned his doctorate in nuclear physics using

declassified results from his work at Los Alamos. French also worked briefly at the new Atomic Energy Research Establishment.

In 1955 French emigrated to the United States to teach at the University of South Carolina. As department chair, French led its vigorous development of research and teaching, and created and taught a course in modern physics. He also wrote his textbook *Principles of Modern Physics*.

French was working in the golden age of science education reform. Many critics were calling for a return to fundamentals “drill and memorization,” but with the launch of Sputnik, the American public demanded higher academic standards in math and science.

In 1956, MIT physics professor Jerrold Zacharias, with support from the National Science Foundation, formed PSSC, the Physical Science Study Committee, a large-scale effort to improve the content and teaching of high-school physics. Zacharias and fellow professor Francis Friedman were impressed by French’s physics book and in 1960 invited French to MIT to attend a one-week PSSC workshop.

In his essay *50 Years Later: Discovering the PSSC: A Personal Memoir*, French declared that the “PSSC had enormous impact on physics teaching, not just in high school but at all levels, and not just in America, but all over the world.”

After being recruited by Zacharias to the MIT physics faculty in 1962, French played a large role in the required introductory physics courses at MIT. “I wanted to be cautious about giving it a name,” said French. “So I called it, blandly, ‘Physics: A New Introductory Course.’ I couldn’t imagine how I could have been so stupid. The students read that as ‘PANIC’ and it was known forever afterwards as the PANIC course!”

In 1970, French was appointed associate chair, and through the 1970s and 1980s he managed the introductory physics courses, taught in them, and wrote his *MIT Introductory Physics Series* books. His books on relativity and waves are still being used today.

French said that his focus more on teaching rather than research made him a bit of an “oddball” at MIT, and he was grateful to Zacharias for his view that the lecturer in physics was as important as the researcher. French advocated having introductory physics concentrate less on content and more on process; it should show students how physicists think. He was an effective user of demonstrations, and enjoyed devising new ones. These demonstrations won him recognition and were the basis for several publications in the *American Journal of Physics*. He also collaborated with Philip Morrison and John King, two other innovative MIT physics teachers. “The good synergy among these three helped MIT physics teaching evolve toward what it has become today,” says Holbrow.

In Remembrance

French was recognized for his participation in international efforts to improve physics teaching. In 1976, he received a Distinguished Service Citation from the American Association of Physics Teachers (AAPT). In 1980, he was awarded the University Medal of the Charles University, Prague, for contributions to physics education, and in 1988, the Bragg Medal and Prize of the Institute of Physics (London) for contributions to the teaching of physics. In 1989, AAPT awarded him the Hans Christian Oersted Medal in recognition of his notable contributions to the teaching of physics, and in 1993 its Melba Newell Phillips Award for “his creative leadership, for his dedicated service, and for his exceptional contributions to physics education.”

French lived in Cambridge, Massachusetts. His first wife, Naomi Livesay French, died in 2001. In 2002 he married Dorothy Jensen-French, and is survived by her and by his children Martin French and Gillian Peck; by his stepchildren Peter, Christine, Katheryn and Lisa; and granddaughter Sara French.

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Institute Professor Emerita Mildred Dresselhaus, a pioneer in the electronic properties of materials, dies at 86

“Queen of carbon science” and recipient of Presidential Medal of Freedom and National Medal of Science led US scientific community, promoted women in STEM.

by the MIT News Office

Mildred S. Dresselhaus, a celebrated and beloved MIT professor whose research helped unlock the mysteries of carbon, the most fundamental of organic elements—earning her the nickname “queen of carbon science”—died February 20, 2017, at age 86.

Dresselhaus, a solid-state physicist who was Institute Professor Emerita of Physics and Electrical Engineering and Computer Science, was also nationally known for her work to develop wider opportunities for women in science and engineering.

“Yesterday, we lost a giant—an exceptionally creative scientist and engineer who was also a delightful human being,” MIT President L. Rafael Reif wrote in an email sharing the news of Dresselhaus’s death with the MIT community. “Among her many ‘firsts,’ in 1968 Millie became the first woman at MIT to attain the rank of full, tenured professor. She was the first solo recipient of a Kavli Prize and the first woman to win the National Medal of Science in Engineering.”

“Millie was also, to my great good fortune, the first to reveal to me the wonderful spirit of MIT,” Reif added. “In fact, her down-to-earth demeanor was a major reason I decided to join this community. Like dozens of young faculty and hundreds of MIT students over the years, I was lucky to count Millie as my mentor.”

A winner of both the Presidential Medal of Freedom (2014) and the National Medal of Science (1990), Dresselhaus was a member of the MIT faculty for 50 years. Beyond campus, she held a variety of posts that placed her at the pinnacle of the nation’s scientific enterprise.

Photo: Donna Coveney

Dresselhaus's research made fundamental discoveries in the electronic structure of semi-metals. She studied various aspects of graphite and authored a comprehensive book on fullerenes, also known as “buckyballs.” She was particularly well known for her work on nanomaterials and other nanostructural systems based on layered materials, like graphene, and more recently beyond graphene, like transition metal dichalcogenides and phosphorene. Her work on using quantum structures to improve thermoelectric energy conversion reignited this research field.

A strong advocate for women in STEM

As notable as her research accomplishments was Dresselhaus's longstanding commitment to promoting gender equity in science and engineering, and her dedication to mentorship and teaching.

In 1971, Dresselhaus and a colleague organized the first Women's Forum at MIT as a seminar exploring the roles of women in science and engineering. She received a Carnegie Foundation grant in 1973 to support her efforts to encourage women to enter traditionally male dominated fields of science and engineering. For a number of years, she led an MIT seminar in engineering for first-year students; designed to build the confidence of female students, it always drew a large audience of both men and women.

Dresselhaus co-authored eight books and about 1,700 papers, and supervised more than 60 doctoral students.

Diverted from teaching to physics

Born on November 11, 1930, in Brooklyn, New York, and raised in the Bronx, Mildred Spiewak Dresselhaus attended Hunter College, receiving her bachelor's degree in 1951 and then winning a Fulbright Fellowship to study at Cambridge University.

While she had planned to become a teacher, Rosalyn Yalow—who would go on to win the 1977 Nobel Prize in physiology or medicine—encouraged Dresselhaus to pursue physics instead. She ultimately earned her MA from Radcliffe College in 1953 and her PhD in 1958 from the University of Chicago, where she studied under Nobel laureate Enrico Fermi. From 1958 to 1960, Dresselhaus was a National Science Foundation Postdoctoral Fellow at Cornell University.

Dresselhaus began her 57-year association with MIT in the Solid State Division of Lincoln Laboratory in 1960. In 1967, she joined what was then called the Department of Electrical Engineering as the Abby Rockefeller Mauze Visiting Professor, a chair reserved for appointments of distinguished female scholars. She became a permanent member of the electrical engineering faculty in 1968, and added an appointment in the Department of Physics in 1983.

In 1985, Dresselhaus became the first female Institute Professor, an honor bestowed by the MIT faculty and administration for distinguished accomplishments in scholarship, education, service, and leadership. There are usually no more than 12 active Institute Professors on the MIT faculty.

Scientific leadership and awards

In addition to her teaching and research, Dresselhaus served in numerous scientific leadership roles, including as the director of the Office of Science at the U.S. Department of Energy; as president of the American Physical Society and of the American Association for the Advancement of Science; as chair of the governing board of the American Institute of Physics; as co-chair of the recent Decadal Study of Condensed Matter and Materials Physics; and as treasurer of the National Academy of Sciences.

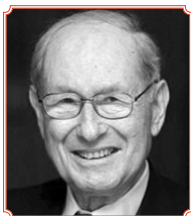
Aside from her Medal of Freedom—the highest award bestowed by the U.S. government upon American civilians—and her Medal of Science, given to the nation’s top scientists, Dresselhaus’s extensive honors included the IEEE Medal of Honor for “leadership and contributions across many fields of science and engineering”; the Enrico Fermi Award from the U.S. Department of Energy for her leadership in condensed matter physics, in energy and science policy, in service to the scientific community, and in mentoring women in the sciences; and the prestigious Kavli Prize for her pioneering contributions to the study of phonons, electron-phonon interactions, and thermal transport in nanostructures. She was also an elected member of the National Academy of Sciences and the National Academy of Engineering.

Active on campus

Always an active and vibrant presence at MIT, Dresselhaus remained a notable influence on campus until her death. She continued to publish scientific papers on topics such as the development of 2-D sheets of thin electronic materials, and played a role in shaping MIT.nano, a new 200,000-square-foot center for nanoscience and nanotechnology scheduled to open in 2018.

Dresselhaus is survived by her husband, Gene, and by her four children and their families: Marianne and her husband, Geoffrey, of Palo Alto, California; Carl, of Arlington, Massachusetts; Paul and his wife, Maria, of Louisville, Colorado; and Eliot and his wife, Françoise, of France. She is also survived by her five grandchildren and by her many students, whom she cared for very deeply.

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Arthur Kerman, professor emeritus of physics, dies at 88

by Sandi Miller for the Department of Physics

Arthur K. Kerman, professor emeritus of physics and a distinguished researcher in MIT's Center for Theoretical Physics and Laboratory for Nuclear Science, passed away May 11, 2017, at the age of 88.

“He was a wonderful friend and colleague, accomplishing many important things in the creation and promotion of science,” said Professor of Physics Emeritus Earle Lomon. “We will greatly miss his friendship and guidance.”

Kerman was known for his work on the theory of the structure of nuclei and the theory of nuclear reactions, publishing or co-publishing more than 100 papers over his career. His research included nuclear and high-energy physics, astrophysics, and the development of advanced particle detectors. His interests in theoretical nuclear physics included nuclear QCD-relativistic heavy-ion physics, nuclear reactions, and laser accelerators. He was an early advocate of the importance of quarks for understanding nuclear physics.

Kerman graduated in 1950 from McGill University, where he studied physics and mathematics. He completed his doctoral work on nuclear surface oscillations at MIT in 1953 under the direction of Victor Weisskopf. From 1953 to 1954, he studied with R.F. Christy at the California Institute of Technology as a National Research Council Postdoctoral Fellow, and in 1954 he began a two-year stay at the Institute for Theoretical Physics in Copenhagen. He joined the MIT faculty in 1956, where he would become the director of MIT's Center for Theoretical Physics from 1976 to 1983 and the director of the Laboratory for Nuclear Science from 1983 to 1992. Kerman officially retired from MIT after 47 years in 1999, but continued to mentor the last of his 43 students until 2006.

Kerman was a fellow of the American Physical Society, the American Academy of Arts and Sciences, and the New York Academy of Sciences.

He was named a Guggenheim Fellow in Natural Sciences. He was associate editor of *Reviews of Modern Physics*.

Throughout his career, Kerman was a leading advocate for new initiatives in science and education. He participated in the Physical Science Study Committee (PSSC), an MIT-led group of high school and university physics professors organized in 1956 to write a physics course curriculum that would convey a sense of excitement and inquiry lacking in traditional teaching. By 1964, about half of U.S. high school students were using the resulting course materials. Kerman would later collaborate on the MIT-produced, PSSC-inspired experimental course, “Physics: A New Introductory Course,” nicknamed “PANIC” by students.

Kerman offered guidance as a consultant or on advising committees to several national laboratories, including Argonne, Brookhaven, Lawrence Berkeley, Lawrence Livermore, Los Alamos, and Oak Ridge, as well as to the Knolls Atomic Power Laboratory and the National Bureau of Standards (now NIST). He also served on numerous other influential bodies, including the Secretary of Energy Fusion Policy Advisory Committee, the White House Science Council Panel on Science and Technology, and the Department of Energy’s Inertial Confinement Fusion Advisory Committee.

“Whenever you work on an exciting new science project, Arthur is sure to tell you that he was involved in the very early stages of that project,” said Michael N. Kreisler, SAIC contractor to the National Nuclear Security Administration at the US Department of Energy and physics professor emeritus at University of Massachusetts, Amherst, at a 2012 conference at CERN. “While it sometimes seems impossible for him to have actually done as much as he says, I know from experience that it really is true.”

A longtime resident of Winchester, Massachusetts, Kerman is survived by his wife of 64 years, Enid Ehrlich, and his children Ben, Dan, Elizabeth, Melissa, and Jaime. He is also survived by 11 grandchildren and two great-grandchildren.

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