Hughes, who was setting out to test quantum electrodynamics (QED) with precision experiments on positronium and other simple atomic systems.

After construction of the Yale tandem accelerator during the 1960s, Jack joined the Wright Nuclear Structure Laboratory, which was then directed by D. Allan Bromley. There Jack used Coulomb excitation to study the structure of deformed nuclei. He produced the first Yale tandem PhD graduate—Richard F. Casten—who now directs the lab.

Jack's experiments evolved into studies of the emission dynamics of x rays produced during nuclear collisions of systems such as nickel + nickel. Those results led to speculations that a new phenomenon would occur during heavy-ion collisions as ephemeral "atoms" are created with nuclear charge $Z_u > 1/\alpha \approx 137$; the result would be a spontaneous emission of positrons, dubbed "sparking of the vacuum." That tantalizing possibility inspired Jack to conduct experiments at the Gesellschaft für Schwerionenforschung (GSI) in Darmstadt, Germany, in the late 1970s. In those studies, he and his group, and a competing group, led by Paul Kienlie and also using the GSI heavy ion beam, observed the broad spectrum of such positrons, much as predicted by QED.

During GSI experiments that involved a variety of species, the two groups also observed a narrow positron line superimposed on the broad spectrum at approximately 320 keV. However, if the line was due to sparking of the vacuum, it was predicted to have an energy varying as Z_u^{20}. The absence of that dependence suggested that a new particle had been created, although the line was possibly due to a not yet understood background process. If the 320-keV line was due to a new particle, it should also have been observable in electron–positron collisions.

With a positron beam at Brookhaven National Laboratory, Jack and colleagues carried out experiments in 1992 that yielded negative results for a range of properties of such a new particle but still left open some possibilities. A new bound state of the electron–positron system would have presented a serious problem for QED, so the interpretation of the line had important theoretical implications. Unfortunately, a subsequent experiment at Argonne National Laboratory took place in 1995 when Jack's health was declining and he was unable to fully participate. Moreover, it was uncertain whether the conditions of Jack's GSI experiment were properly re-created at Argonne. So the definitive status of the discrete line remains unclear.

Jack's long association at Yale, until his retirement in 1999, involved promotions through the ranks to professor in 1976. During his distinguished career, he was director of graduate studies from 1967 to 1969, held a senior faculty fellowship from 1969 to 1970 at the Weizmann Institute in Rehovot, Israel, and won a Senior US Scientist Award from the Alexander von Humbolt Foundation in 1976.

Jack's many admirers consistently noted his exercise of unusual caution before reaching conclusions based on experimental data, and his untiring desire for additional experiments to reduce statistical effects. His meticulous search for perfection in physics was reflected in his nonscientific endeavors, which included his taste for exotic motor cars, his quest for the state-of-the-art home reproduction of the grand opera repertory, and his exceptional collection of antique oriental carpets. His maxim—as in physics—was that no activity (or commodity) was worth doing (or acquiring) if it risked compromising perfection. Jack's warm, engaging personality and willingness to share valuable insights with colleagues and students are sorely missed by those at Yale and by his loving family, who were privileged beneficiaries of his remarkable gifts.

Moshe Gai
Jay L. Hirshfield
Jack Sandweiss
Yale University
New Haven, Connecticut

Kenneth Charles Hass

Kenneth Charles Hass, a theoretical condensed matter physicist, died on 1 June 2005 in Ann Arbor, Michigan, after a long, courageous, and graceful bout with cancer. At the time of his death, he led 60 physicists, chemists, and engineers as manager of the physical and environmental sciences department at the Ford Motor Co.

Ken was born in Flushing, New York, on 7 May 1958 and attended Queens College, where he earned a BA, summa cum laude, in physics and mathematics in 1979. He attended graduate school at Harvard University under an NSF graduate fellowship and received an AM in 1980 in physics and a PhD in theoretical solid-state physics in 1984. His thesis adviser, Henry Ehrenreich, remembers Ken as one of his "most broadly interested and imaginative graduate students, whose friendliness, helpfulness, and modesty were inspiring to anyone who had the privilege of working with him." Ken held joint appointments as a postdoctoral fellow at Harvard and a visiting scientist at MIT before joining Ford's Scientific Research Laboratory in 1987.

Initially Ken's research focused on the effects of disorder in semiconductor alloys, the electronic structure and magnetic properties of diluted magnetic semiconductors, the electronic properties of copper oxide–based high-T_c superconductors, and the vibrational and thermal-transport properties of isotopically modified diamond. Among the dozens of papers he wrote on these subjects, his 1989 chapter "Electronic Structure of Copper-Oxide Superconductors" in *Solid State Physics* certainly stands out as a seminal publication.

Ken made theoretical contributions to many Ford projects. The most significant work from a scientific and societal perspective was his groundbreaking density functional theory studies of the adsorption and catalysis of nitrogen oxides (NO_x) on metals, zeolites, and oxides and of the bulk and surface structures and hydration of aluminas. Those issues are central to air-quality improvement technologies, including automotive emission controls.

In 2001, Ken became the manager of the chemical and environmental sciences department, and beginning in 2002, he led the organization formed by its merger with the physics department. Ken responded to the challenging times in the automotive industry by arguing successfully that


JIM BRETZ, FORD MOTOR CO

Kenneth Charles Hass

critical research areas such as environment, energy, safety, and new materials demanded long-term support from Ford.

Ken was equally at home in the academic and corporate worlds. He had a lifelong interest in science education. While leading a strong materials-modeling effort at Ford, he simultaneously served on the American Physical Society's committee on education (1998–2000), including one year as its chair. Ken worked tirelessly to promote and expand the activities of the APS forum on industrial and applied physics during his tenure as vice chair, chair, and past chair (2001–04). He wrote and spoke eloquently of the need for new approaches and attitudes in industrial research and academia. Ken was elected an APS fellow in 2004 in recognition of his significant applications of atomic-level modeling to technological materials and his outstanding leadership in the promotion of industrially relevant research and education.

A yearlong sabbatical (1999–2000) in the physics department at the University of Michigan, Ann Arbor, enabled Ken to explore ideas from the emerging field of complexity. On returning to Ford, he applied the new ideas to technical management and other complex problems. Working closely with the Center for Complex Systems at Michigan, he encouraged applications of this discipline to practical problems such as sustainable mobility.

An avid reader, Ken appreciated the complementary approaches of scientific reductionism and the view that fundamental laws exist at all levels of the physical world. He thought seriously about the roles of science and religion. His personal interests included travel, food and wine, chess, tennis, and music.

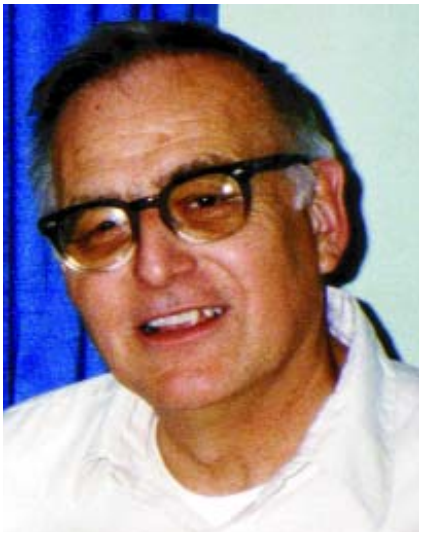
Those in the physics community who read Ken's papers or heard him speak will remember him as a first-rate scientist. Those at Ford can also attest that he was a leader who possessed outstanding vision and integrity. He was a terrific colleague and friend, and we all miss him.

L. Craig Davis
Plymouth, Michigan
John M. Ginder
Ford Motor Company
Dearborn, Michigan
Willes H. Weber
Santa Barbara, California

Lyman Mower

Lyman Mower, known for his theoretical work on the interactions of microwaves with plasmas and on transitions between closely coupled atomic states, died of cancer at his home in Durham, New Hampshire, on 20 December 2004.

Lyman was born on 15 June 1927 in Berkeley, California. After service



Lyman Mower