

Bruce was born in New York City on 9 December 1919 and was a 1940 magna cum laude physics graduate of Fordham University in New York. He went to NRL in 1948 after serving in the US Army in World War II. In 1963, while employed in NRL's solid-state physics division, he received his PhD in physics from the Catholic University of America. His thesis, prepared under the guidance of W. Dale Compton, was titled "Color Centers in KCl and KBr by Prolonged X-Radiation at Low Temperatures."

Bruce's thesis work evolved into a career studying radiation's effects on materials. The early 1960s marked the beginning of the US Navy's interest in the effects of radiation on satellite components, and Bruce became an active researcher in solar cells and was well known at the photovoltaic specialists' conference of the Institute of Electrical and Electronics Engineers. He also was very involved in the more fundamental International Conference on Defects and Radiation Effects in Semiconductors sponsored by the IEEE. That work expanded to include radiation damage to other semiconductor devices, including the phenomenon of single-event upset. From 1974 to 1984, Bruce headed NRL's radiation effects branch.

Bruce's managerial skills at NRL were legendary; he relied on a personal touch. For example, he would spend many a day on the phone with navy sponsors, talking mostly about sports (he was passionate about the New York Giants baseball and football teams) and occasionally about new navy programs he had developed. The approach worked; Bruce and his staff enjoyed many years attacking and solving critical technical problems for the navy.

In 1981 Bruce's contacts at Naval Sea Systems Command (NAVSEA) and Naval Air Systems Command (NAVAIR) steered him toward a new hot area of materials research: radar-absorbing materials. Bruce was familiar with NRL's ferrite materials expertise, saw the possibility of radar absorption in the ferrites, and started a program called Project Newboy. Newboy rapidly evolved into the low observables materials and structures group, which Bruce headed until his retirement in 1986. He received the Navy Superior Civilian Service Award in 1981 for that project, and the program remains an important research area at NRL.

Bruce's leadership and guidance profoundly influenced many people at NRL. He nurtured his staff, got them interested in the work, and then gave

them all the credit. We at NRL still point to Bruce's techniques as the way to manage scientific personnel and develop research programs. More important, he was a great friend to many of us and will remain in our memories always.

**Carmine Carosella
Graham Hubler**

*Naval Research Laboratory
Washington, DC*

Jack Sam Greenberg

Jack Sam Greenberg, professor emeritus of physics at Yale University and an experimental physicist who made exceptionally broad fundamental contributions to atomic, nuclear, and high-energy physics, died on 30 March 2005 in New Haven, Connecticut, from complications following an accidental fall at his home.

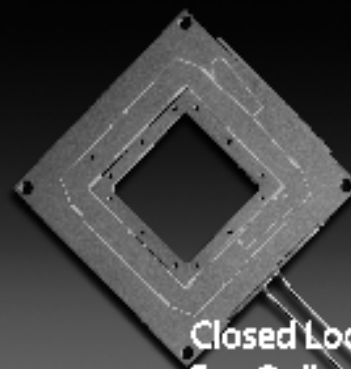
Jack was born on 23 May 1927 in Warsaw, Poland, but was fortunate in that he and his immediate family immigrated to Canada in 1934 and thus escaped the catastrophes of World War II that swallowed up virtually all other members of his family. He earned a bachelor's degree in engineering in 1950 and an MS in engineering physics a year later from McGill University. For his doctorate, Jack moved to MIT and worked on positron emission from beta decay. He received his PhD in physics in 1955 under the tutelage of Martin Deutsch, who had discovered positronium in 1951.

Jack next spent a postdoctoral year at ETH Zürich, where he attended lectures by Wolfgang Pauli. He joined Yale in 1956 as an instructor in physics. That choice was motivated partly by the arrival at Yale of Vernon



Jack Sam Greenberg

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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 Kienle 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 Humboldt 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



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Kenneth Charles Hass