

sential institutional support, led to the building of a strong and exciting department, which then went on to grow in particle physics, solid-state physics and astrophysics. However, Lloyd did not confine his efforts to the physics department. From his military and industrial consulting experiences, he recognized the need for training in physics appropriate to a broad array of careers, and with several other experienced faculty members he established and directed the School of Applied and Engineering Physics at Cornell, which has been preeminent in that field since its inception.

By 1956 Lloyd had become increasingly interested in research planning and policy, and he left Cornell for a series of executive positions at Avco, Ford Aeronautics, the Stanford Research Institute and the Desert Research Institute. At Avco he directed the development of a reentry vehicle for ballistic missiles. At the time of his death he was still active as a consultant in R&D planning.

Lloyd was a versatile physicist, one who carried out research in mathematical physics, atomic and electron physics and microwaves. After the war he recognized that the new microwave technology had opened the possibility of constructing a coherent quantum oscillator using the ammonia molecule inversion. However, the apparatus he built to realize this possibility was not able to achieve the necessary population inversion, which Charles Townes did achieve to make the "maser" workable. Perhaps Lloyd's greatest strength was his ability to combine powerful mathematical analysis with a deep practical insight into problems in physics or engineering.

His buoyant, engaging and persuasive personality will be remembered. He was an able tennis player and an avid fan, an accomplished musician and a vivid raconteur. He was a builder, teacher, scientist and adviser. But in the final analysis the university years were closest to his heart; his last *Who's Who* entry closes with the statement that of all his achievements he was proudest of the good students he had had. His associates over the years, especially those students, will remember him with warm regard.

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Murray A. Lampert

Murray A. Lampert, emeritus professor of electrical engineering at Princeton University, died on 4 August 1988 at the Princeton Medical Center.

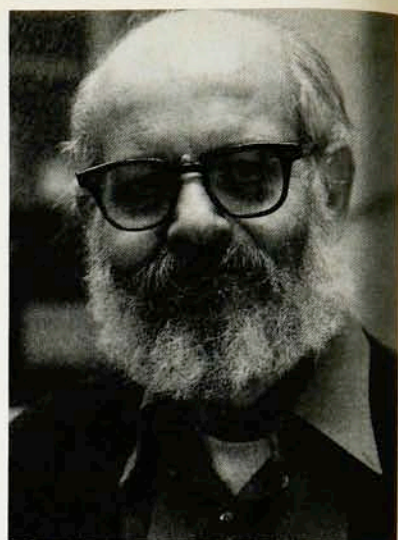
Lampert was born in New York City in 1921. He received a BA in mathematics from Harvard in 1942, and an MA in physics from Harvard in 1945.

Lampert was a teaching fellow in physics at Harvard in 1942-43 and an instructor in electronics at the Harvard Electronics Training School (for Armed Services personnel) from 1943 until 1945. In 1945 he headed the lens design group at the Optical Research Laboratory of the Harvard Observatory. From 1946 until 1948 he was a member of the theoretical group of the Radiation Laboratory of the University of California, Berkeley, where he worked on high-energy problems in nuclear physics. He worked at the Federal Telecommunication Laboratories (now the ITT Laboratories) from 1949 until 1952, studying traveling wave tubes and the interaction of microwaves with plasmas. The latter work resulted in the dielectric gyrator, which he coinvented with L. Goldstein and J. Heney.

Lampert joined the RCA Laboratories in 1952, and in 1958 became a member of the theoretical solid-state group, where he gave particular attention to the electronic physics of insulators. In the fall of 1966 Lampert was appointed professor of electrical engineering at Princeton, where he taught graduate courses in solid-state fundamentals and in insulator physics. During his university career he initiated research projects on charge injection and high-field transport of charge carriers in insulators and on the electronic properties of interfaces between thin insulating films and semiconducting substrates. In 1970, together with Peter Mark, he wrote *Current Injection in Solids*, the definitive book of its field.

One of Lampert's qualities was his irreverent appreciation of the absurdities of life, a characteristic that surfaces in the following quotation from his short autobiographical sketch:

In 1966, in a strangely unrealistic effort to flee reality, I made a miscalculation of epic proportions and settled into a Grove of Academe. Three coronaries and one lengthy heart operation later I retired from that bizarre arena. At which point the thought occurred to me that possibly we dwell in a hazardous, uncertain world. And so currently, to explore further the mysteries of this familiar, unknown world I



Murray A. Lampert

am studying biology and psychology—areas richly dense with unanswered and unanswerable questions. I also do a modest amount of consulting on the more comfortable terrain of solid-state physics.

During the last ten years of his life, Lampert studied some of the highly nonlinear equations that describe biological systems. He made the remarkable discovery that a spherical charge in an electrolyte becomes perfectly screened as the radius of the sphere tends to zero.

In studying these problems, Lampert used a powerful technique he had devised earlier to investigate highly nonlinear differential equations, namely the regional approximation. This consists of partitioning the space within the boundaries of the problem, retaining only the dominant terms of the equation in each region, and matching the solutions at the partition boundaries. He once said that this approach was one of the most useful tools in his analytical arsenal, and that while it sacrificed numerical accuracy, it greatly augmented physical insight.

And this was Murray Lampert's hallmark: keen physical insight. His mathematical analyses of the problems at hand, incisive as they were, never obscured the beautifully simple physical principles at work. He will be remembered for his integrity, his devotion to science, his lively mind, his cosmopolitan interests and his unstinting collaboration with his colleagues.

ALBERT ROSE
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WALTER CURTIS JOHNSON
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