OBITUARIES

Noah Hershkowitz

On 13 November 2020, the plasma-physics community lost distinguished scientist and teacher Noah Hershkowitz, the Irving Langmuir Professor Emeritus of Engineering Physics at the University of Wisconsin–Madison (UW–Madison). Few have contributed so much and so broadly to the field of plasma science. Noah's work was foundational in nature, but it profoundly influenced applications spanning the gamut from materials processing to fusion. He guided generations of plasma physicists, probed theories and assumptions, and provided international leadership in the plasma-physics community. He was the founding editor in 1992 of *Plasma Sources Science and Technology*, which has become the premier venue for disseminating low-temperature plasma science.

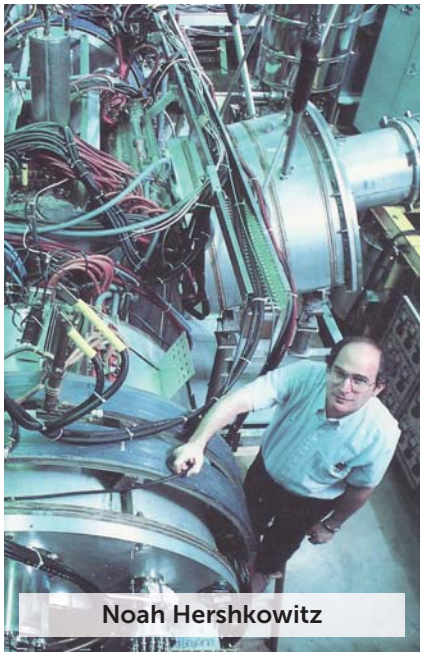
Noah was born on 16 August 1941 in Brooklyn, New York, and attended the High School of Music and Art. He earned his bachelor's degree at Union College in 1962. While taking an honors physics course there, he and another student fabricated a working ruby laser only two years after the first laser was built. Noah was 24 when he earned his PhD in physics from Johns Hopkins University; under adviser J. C. Walker, he worked on experimental Mössbauer spectroscopy. After teaching at the university for about a year, he joined the physics department at the University of Iowa.

Noah started out as a nuclear physicist. However, his fascination with a 1971 colloquium about electrostatic shocks in laboratory plasmas motivated his abrupt shift to plasma physics, despite his never having taken a single course on the topic. He thought it would be fun. His beginning foray included the study of solitons and double layers, and his results challenged the conventional wisdom regarding those curious structures. Noah always asked basic questions first—such as, How does plasma potential get from point A to point B?—to get to the core of the underlying science. His fundamental plasma-physics experiments led to his development and refinement of emissive probe techniques for measuring plasma space potentials. His work is now the basis for how emissive probe measurements are made in fields ranging from processing plasmas to Hall thrusters.

While on a sabbatical in 1980 at the University of Colorado Boulder, Noah was recruited to take charge of the large-scale Phaedrus tandem-mirror fusion program at UW–Madison, which he did later that same year. Noah steered Phaedrus in a new direction. The program conducted groundbreaking experiments that featured a simplified axisymmetric coil set and achieved magnetohydrodynamic stabilization through externally applied RF power, the first tandem-mirror machine to do so. The results from the Phaedrus-B tandem-mirror device continue to influence designs worldwide. Noah also served on many US Department of Energy mirror program committees, including the US/Japan Joint Planning Committee on tandem mirrors, and in 1989 he was a key participant in the DOE Office of Fusion Energy's US/USSR exchange program.

When DOE focused efforts on the tokamak fusion-confinement concept in the late 1980s, Noah built the Phaedrus-T tokamak, but he also began working on low-temperature plasma physics as the basis of semiconductor device manufacturing. His pioneering research helped to advance that critical technology at a time when it was responsible for maintaining Moore's law. Noah led the plasma-etch group at UW–Madison's Center for Plasma Aided Manufacturing for over a decade, and he was the center's director for more than a decade after that. His characteristic integrity and leadership helped the US regain competitiveness in the microelectronics industry.

Although he led thriving fusion energy and technology research programs, Noah never let go of the fundamental research he pursued at the beginning of his career. The sorts of questions that held a special fascination for him were those that challenged assumptions in plasma physics that dated back to Irving Langmuir's work in the 1920s but that had no definitive experimental benchmark. Noah's advances in probe- and laser-based diagnostics allowed him to make seminal measurements of the "sheath problem," which describes the electrostatic boundary layer responsible for mediating the interaction between plasmas and materials surfaces.



Noah Hershkowitz

UNIVERSITY OF WISCONSIN–MADISON

Noah spent the last half of his career in a wheelchair, dealing with, and often just ignoring, primary progressive multiple sclerosis. His ability to work undaunted by the disease was an inspiration. A brilliant teacher and a kind and generous mentor, he cared enough to create an environment where everyone—a vast, diverse "everyone"—could thrive.

"Physics is like a jigsaw puzzle that's really old," Noah once said. "All the pieces are worn down. Their edges are messed up. Some of the pieces have been put together in the wrong way. They sort of fit, but they're not actually in the right places. The game is to put them together the right way to find out how the world works."

Noah is mourned by plasma physicists throughout the world.

Gregory Severn
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San Diego, California
John Foster
Scott Baalrud
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