LESTER MACHTA

effort. ARL assisted in this testing by providing information on transport of the fallout, which eventually encircled the world. At that time, Machta proposed that the radioactive materials could be used as tracers to understand weather systems. Eventually, because of human health concerns, the atmospheric testing was banned in 1963. However, because countries continue testing and producing nuclear weapons to this day, Machta worked on this subject until his death.

Although radioactive material in the atmosphere was a major concern during the 1960s, it was soon realized that humankind was affecting the environment in more subtle ways. Machta had an admirable gift for identifying issues—for example, the continuous increase in carbon dioxide—that would seriously impact the environment and the climate. Through the pioneering work of David Keeling, CO_2 was being measured at Mauna Loa and on the South Pole. Machta played a critical role in the early 1970s, however, taking over the operation and maintenance of the Mauna Loa Observatory, which was on the verge of being closed due to funding shortfalls. He was instrumental in establishing, in 1971, the geophysical monitoring for climate change program (now in the Climate Monitoring and Diagnostics Laboratory/NOAA) long before climate change became a household term. Besides saving Mauna Loa, he established new global observatories in Barrow, Alaska, and American Samoa. These global stations, in addition to the South Pole station, and another 18 observatories around the world continue to provide scientific measurements for an understanding of global climate change.

Machta also deserves recognition for his work in the area of stratospheric ozone. Measurement of total column ozone goes back to the 1930s with the development of the Dobson spectrophotometer. This instrument measures the amount of ultraviolet (UV) radiation absorbed by ozone in the stratosphere and, using different pairs of wavelengths, can determine the amount of ozone in a column above the observer. A network of Dobsons was established during the International Geophysical Year (1957–58) and continues to take measurements to this day. At ARL in 1971, Machta, who realized the importance of such measurements, established a unit that would not only measure total column ozone around the world but also ensure the calibration of the Dobson spectrophotometers. Thus, through his foresight, a measurement system was well in place by the 1970s, when the question of chlorofluorcarbons and their effect on the depletion of the stratospheric ozone layer was raised.

Those who have known Machta were fascinated by the breadth of his many scientific interests. ARL, with which he was associated for almost 50 years, reflected this diversity. Besides ARL headquarters in Silver Spring, Maryland, there are five branches throughout the US. Machta orchestrated these units in a very low-key manner with carefully chosen, competent scientific leaders. Under Machta's leadership, ARL has contributed to such diverse fields as modeling regional air pollution, measuring UV radiation, developing a network to monitor wet and dry deposition, and understanding the dispersion and diffusion of materials from a source such as a nuclear power plant.

Unquestionably, Machta was on the forefront of environmental science for many years. His colleagues have many memories of his quiet nature, which would not bend to pressure to bypass the science. Machta expressed his concern for others in an understated way, exemplified by his always insisting on leaving an elevator last, even in the presence of much younger men—which often resulted in a humorous "after you, Gaston" standoff—and standing aside in a circle of friends to let an approaching party—no matter how junior or unknown—join the discussion. He was not one to show anger even when it would seem appropriate. On meeting this well-known laboratory director and scientist, junior colleagues, who might have expected to find a less accessible person, were surprised by his gentle nature. Machta's colleagues and friends have been enriched by working with him and will miss his guidance and patient understanding.

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Philip Edward Seiden

Philip Edward Seiden, a condensed matter physicist, astronomer, immunologist, and manager, died 21 April 2001 in Briarcliff Manor, New York, of complications arising from long and largely successful battles with cancer and heart disease.

Phil was born in Troy, New York, on 25 December 1934. He received his MS in physics in 1956 from the University of Chicago and then earned his PhD in physics from Stanford University in 1960 under the direction of John Shaw. His doctoral research was on magnetic resonance of yttrium iron garnets.

Phil spent the major part of his life working at IBM Corp's T. J. Watson Research Center in Yorktown Heights, New York. Starting in 1960 as a research staff member, he quickly rose through the management ranks and was appointed director of the physical sciences department (1972–76) and then of the general sciences department (1976–77). He worked in the areas of magnetism, superconductivity, and organic solids during the early stages of his career at IBM. As early as 1973, Phil foresaw the field of molecular electronics, and, in 1974, he and Ari Aviram received the first patent in this field. Phil championed the study of organic materials at IBM throughout his life.

Restless to do basic research, Phil left management in 1977 and spent the rest of his time at IBM working in areas that interested him. He began a second career in astronomy with his pioneering work on the spiral structure of galaxies. By introducing a stochastic model in which star formation propagates around inside a shearing galaxy disk, Phil and his colleagues Humberto Gerola and Lawrence Schulman demonstrated during the period 1978–84 that the optical appearance of spiral structure could be the result of sheared star formation. They also found that star formation in very small galaxies should vary strongly with time because of the same propagation phenomena.

In 1989, in collaboration with Bruce and Debra Elmegreen, Phil discovered symmetric interference patterns in the intensity of spiral arms. This was the

PHILIP EDWARD SEIDEN

first experimental evidence for the existence of spiral-wave modes in the stellar disks of galaxies, and the first confirmation of a theory proposed 10 years earlier by C. C. Lin.

In the 1990s, Phil's astronomical work centered on solar active regions. He showed that percolation phenomena can explain the appearance, lifetime, autocorrelation, and size distribution of sunspots. These results were based on computer models that he created over time in collaboration with Donat Wentzel of the University of Maryland, College Park. From 1983 until 1997, the Smithsonian Institution's Air and Space Museum in Washington, DC, featured a movie exhibit devoted to Phil's spiral galaxy work.

Immunology was at the center of Phil's attention during the last phase of his research life. He approached his work in this field in a truly multidisciplinary manner. His remarkably productive collaboration with Franco Celada, a basic immunologist from Genoa, Italy (Phil described Celada's title as "mouse-sticking immunologist"), began in 1987, when Phil quite serendipitously met Celada, who was working at the Hospital for Joint Diseases Orthopaedic Institute (HJD) in New York City. In 1992, the collaboration resulted in a computer model called IMMSIM (for immune simulation) that was based on a modified cellular automaton. A comprehensive model was created in 1997. Both the immunologist and the physicist were fascinated by the central role of the discrete stochastic encounters among specific cells that precede and condition the clonal expansion. Phil modeled the system to reflect the fluctuations that occur because of the distinct populations that initiate the response. IMMSIM turned out to approximate the outward workings of an individual's immune response and also to allow the performance of real immunological experiments by introducing parameter changes—each change representing a hypothesis—and observing the results on the screen. These experiments were called "in machina" in analogy to the classical in vivo and in vitro tests. The model is widely used as a research tool, for example, to predict the efficiency of a vaccine or focus experimental protocols.

When they tackled infection by model viruses, Celada and Phil, with their small team of American and Italian modelers, discovered that the relative efficiency of cell-mediated and antibody-mediated responses mounted by the immune system are dictated by the virus's characteristics, and that the two kinds of response often collaborate but sometimes compete with the evolutionary goal of offering the most apt defense. The fluctuations captured by IMMSIM have often turned out to look like some failures of immunity, and Phil exploited these examples to try to understand autoimmunity. As a result, Phil, with Martin Weigert and collaborators at Princeton University, developed the competitive tolerance hypothesis, which proposes a novel way by which autoantibodies may be regulated.

After retiring from IBM in 1997, Phil continued his research in immunology, both as a consultant on IMMSIM grants at HJD and as an adjunct faculty member at Princeton University, where he devoted his time to research and teaching. During his years at Princeton, Phil discovered IMMSIM's value as a teaching tool and used it for both a graduate course and a freshman seminar. His enormous talent for teaching became apparent—his students consistently rated the course as the best they had ever taken. His total commitment to the scientific process earned him the respect and awe of his students and colleagues. On the last day of his life, he modified IMMSIM to fit a particular experiment, e-mailed his students to advise and encourage them as they pursued their projects, and thanked them for discovering a bug in IMMSIM.

Phil's zest for life was very strong. He was ebullient, energetic, interactive, and ready to debate on subjects ranging from science, through linguistics, to gastronomy. An active participant in professional committees, he also enjoyed traveling, spending sabbaticals at the University of Grenoble, France; the Technion–Israel Institute of Technology in Haifa, Israel; and Indiana University. He was a kind and generous mentor, colleague, and friend.

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Eric Thomas Swartz

Eric Thomas Swartz, the founder and vice president of technology at Desert Cryogenics in Tucson, Arizona, died on 8 September 2001, after a long and gallant battle against leukemia. With his passing, the low-temperature physics community lost one of its youngest and brightest scientists, and Eric's family lost a devoted husband and dedicated father to four children.

Eric was born in Levittown, New Jersey, on 19 November 1959 and grew up in the Buffalo, New York, area. He began attending Rice University in 1977, graduating in three years with BS degrees in mathematics and physics. He then received an MS in mathematics from Rice in 1981 and a PhD in physics from Cornell University, under thesis adviser Robert O. Pohl, in 1986. Eric's doctoral dissertation on thermal boundary resistance at cryogenic temperatures was published in the July 1989 issue of the *Review of Modern Physics*. This research extended the mathematical understanding of Kapitza resistance, and the review has been cited numerous times in the technical literature.

Eric was regarded as one of the top cryogenic system designers of his time. At age 17, he designed his first cryostat, a 4.5-K refrigerator, while working a summer job at Lake Shore Cryotronics in Westerville, Ohio. While a graduate student at Cornell, Eric developed an improved helium-3 cryostat that could be inserted into a standard helium-4 dewar, thus allowing routine measurements to be conducted at temperatures from 0.28 K to more than 400 K. This design and designs for helium-4 cryostats were published in the *Review of Scientific Instruments*.