previously believed—the best estimate was about five core damage events every 100 000 reactor years, with an upper bound of three events per 10 000 reactor years. In addition, it was determined that the accident consequences were significantly smaller than previously believed.

Opponents of nuclear power attacked the report vigorously. Norm did a remarkable job defending its methods and results. He gave several hundred lectures around the world and media interviews and press conferences. The significance of the report's methods and findings was soon recognized. In 1982, President Ronald Reagan appointed Norm as a member of the National Science Board, on which he served for six years. He received the US Department of Energy's highest scientific award, the Enrico Fermi Award, in 1985.

The methods of the Rasmussen Report have stood the test of time. Probabilistic risk assessment is now recognized as a discipline and is used internationally for nuclear power plants and other major technological facilities. The report has allowed the NRC to issue quantitative health objectives and to pioneer the development of risk-informed regulations, with the goals of maintaining safety, increasing public confidence in the regulatory system, and removing the unnecessary regulatory burden that results from excessive application of defense in depth.

Norm was an avid skier and a dedicated birdwatcher. He was extremely quick witted, with a marvelous sense of humor. According to Kent Hansen of MIT, who knew Norm since his graduate student days, Norm was once testifying before the US Senate about the Reactor Safety Study. Senator John Pastore of Rhode Island was chairing the session. The quorum bell rang; the senator interrupted Norm to say that the senators would have to leave in a few minutes and asked Norm how much longer he needed. Norm replied, "Senator, that depends on how smart you are." The staffers and members of the NRC were aghast. Pastore roared with laughter and said perhaps they'd better adjourn now and save some time for Norm for another appearance.

Norm was a major figure in the field of reactor safety. Those of us who knew him consider ourselves fortunate to have worked with him, enjoyed his wit and great sense of humor, and benefited from his wisdom.

George E. Apostolakis
Massachusetts Institute of Technology
Cambridge

Michael Dudley Sturge

Michael Dudley Sturge, best known for his contributions to solid-state spectroscopy, died of leukemia on 13 July 2003 in Castleton, England.

Born on 25 May 1931 in Bristol, England, Michael obtained his BA in engineering and physics (1952) and his PhD in physics (1957) at Cambridge University, where he worked on superconductors under Brian Pippard. After two years at Philips Labs outside London, Michael moved to the Royal Radar Establishment in Malvern, where he published, in *Physical Review*, his paper on the spectroscopy of gallium arsenide. That work included GaAs band structure parameters (most timely for the GaAs laser, invented in the same year) and the first observation of Wannier–Mott excitons in a III–V semiconductor. The paper became a citation classic and brought him international recognition.

In 1961, Michael joined Bell Labs in Murray Hill, New Jersey. During his more than 20 years as a member of the technical staff, he grew into one of the leading experts on the optical properties of semiconductors and commanded a tremendous level of respect within that highly skilled community. His expertise, intense level of scientific curiosity, and personal and scientific integrity attracted many young scientists to Bell Labs, and he became a cherished mentor to many of them.

In 1984, Michael joined Bell Communication Research in Murray Hill, an R&D firm that had split from Bell Labs. Two years later, he became a professor of physics at Dartmouth College.

Michael first worked on the spectroscopy of transition-metal ions in crystals, basic solid-state laser materials. By combining optical and electron paramagnetic resonance spectroscopies, he identified the role of the dynamic Jahn–Teller effect in ion-level splitting and the collective Jahn–Teller effect in phase transitions of rare-earth perovskites.

In the mid-1970s, Michael returned to the fundamental optical properties of semiconductors. He studied the excited states of excitons bound to isoelectronic nitrogen pairs in bulk gallium phosphide and classified them using the model of a tightly trapped electron and a hole orbiting the pair. When the interest of the semiconductor community turned to quantum wells and superlattices, he studied transport and cyclotron reso-

Michael Dudley Sturge

nance in two-dimensional electron systems and participated in the discovery of minigaps in metal-oxide-semiconductor field effects and in the initial experiments on modulation-doped superlattices.

In the early 1980s, Michael made important contributions to the spectroscopy of disordered semiconductor systems. By combining experiments of luminescence, resonant Rayleigh scattering, hole burning, and transient grating spectroscopy, he found clear evidence for a mobility gap in the spectrum of excitons in quantum wells. He also discovered a new type of exciton in short-period superlattices, which is indirect in both real and reciprocal spaces, and electric-field controlled switching between the direct and indirect band structures.

Michael's last work was on trions, complexes of a hole and two electrons similar to H^- ions. He discovered a puzzling abrupt changeover in the magnetoluminescence from free-particle to bound-particle behavior when the lower electron Landau level becomes just filled. That observation proved that a "hidden symmetry," known for strong magnetic fields, surprisingly manifests itself in moderate-to-weak fields.

Michael always set the highest standards for his work. He perceived science in its unity and applied that approach when composing, with one of us (Rashba), the volume *Excitons* (North-Holland, 1982), which included reviews of excitons. As the general editor of the *Journal of Luminescence* from 1985 to 1990, Michael expanded its scope to embrace modern research areas. At Dartmouth, he brought the same standards to his teaching, which he continued after retiring from the college in 1998. To introduce students to the dramatic history of physics during the 20th century, Michael worked with them on factual and moral problems raised by Michael Frayn's play *Copenhagen*. He also wrote a textbook on statistical physics that included many recently studied systems.

To honor Michael's scientific achievements and his leadership, the International Conference on Dynamical Processes in Excited States of Solids has established the Sturge Prize for outstanding contributions to solid-state spectroscopy made by young scientists. The prize will be awarded for the first time in 2005.

Michael enjoyed sailing and hiking and had a deep knowledge of history, politics, and philosophy. When visiting Jerusalem in 1972, Michael, in a quiet and almost shy way, kept correcting the old professional guide about historical facts. In 1987, at the Triniti-Sergey Monastery museum near Moscow, Michael noticed that an exhibit designated as "A prayer book of the Czar Ivan the Terrible" was actually published after Ivan's death. The astonished guide explained that the original book was lost, and Michael was the first visitor to notice the inconsistency. Michael commented that it was merely his professional habit to pay attention to details and notice anomalies.

Michael was a prominent researcher and a person of extraordinary standards and integrity. His family, colleagues, and friends will miss him.

Emmanuel Rashba
Massachusetts Institute of Technology
Cambridge
Horst Stormer
Columbia University
New York City
Lucent Technologies' Bell Labs
Murray Hill, New Jersey
Elisha Cohen
Technion–Israel Institute of Technology
Haifa, Israel
John Hegarty
Trinity College
Dublin, Ireland

Gerhart von Gierke

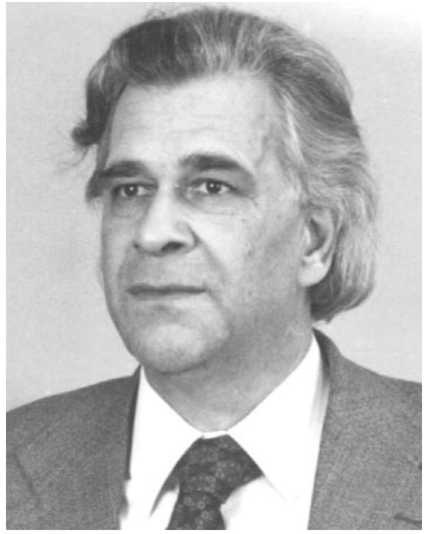
Gerhart von Gierke, a leader in fusion research in Europe, died on 28 June 2003 in Munich. He was one of the founders of the Max Planck Institute for Plasma Physics in Garching, Germany, and spent his entire career at the IPP.

Von Gierke was born in Karlsruhe, Germany, on 14 January 1922. He came from a prominent German family: His grandfather was a famous professor of law, his sister wrote parts of Germany's 1919 constitution, and other relatives participated in the resistance against Adolf Hitler. Von Gierke studied in Heidelberg and received his *diplom* in 1949 and his PhD in nuclear physics in 1953. His thesis was on a photographic momentum spectrograph and its application to the nitrogen-15 and oxygen-17 nuclear transition states. His PhD supervisor was Max Planck's pupil Walter Bothe, who, with Max Born, won the 1954 Nobel Prize in Physics.

After earning his PhD, von Gierke went to the University of Liverpool for two years to investigate the creation and scattering of mesons. He then spent a year at CERN, which was just two years old at the time, before receiving the call to the Max Planck Institute of Physics in Göttingen.

At Göttingen, von Gierke, under the guidance of Werner Heisenberg, turned to the new field of high-temperature plasma physics and fusion research. In the late 1950s, von Gierke and others set up the first stellarator at the IPP, the Wendelstein 1 device, following a concept developed at Princeton University by Lyman Spitzer. The IPP team named the device after a mountain south of Garching; the choice was inspired by the early beginnings of fusion research. Hermann von Helmholtz portrayed research as akin to mountain climbing: Several routes may lead to the peak, but all of them are steep and precarious. In addition, in German, "Wendelstein" alludes to the helix-shaped coil and field configuration of the stellerator. Von Gierke is credited with initiating this pillar of the IPP research program: The Wendelstein line later continued by others has led to the establishment of a fusion power plant concept, the Helias reactor; the IPP is currently building Wendelstein 7-X, a large superconducting stellarator, in Greifswald, Germany, to fully explore and demonstrate its potential.

After successfully initiating the stellarator line, von Gierke turned to the other main toroidal concept and, in 1973, built Pulsator, the first IPP tokamak. The experimental group led by von Gierke then built the ASDEX tokamak in 1980. That tokamak represented a major step in the development of toroidal confinement because it demonstrated the superiority of the divertor to produce clean plasmas and offered a possible means to solve the exhaust problems—the removal of heating power and helium ash—in a



Gerhart von Gierke

later fusion reactor. Most important, a new operational regime, the H-mode, was discovered in ASDEX. The H-mode is a manifestation of the self-organization of open, strongly driven systems. In the H-mode, the plasma dynamics make a distinct transition to a regime in which the goals of fusion are more accessible. Von Gierke played a major role in making the IPP a leader in experimental fusion research.

In the remaining years of his career, von Gierke studied plasma behavior close to stability boundaries. Specifically, he explored the role of the plasma-current density distribution in determining the limitations of the plasma pressures. He retired in 1987.

Von Gierke represented the IPP or Germany as a member of many scientific and administrative organizations. For example, he was one of the driving forces in the realization of the JET project, the world's largest fusion device, built near Oxford, England. For many years, he was a member of the JET supervisory board and, later, a member and vice chairman of the JET executive committee. He also was chairman of the International Atomic Energy Agency's International Fusion Research Council.

Von Gierke's family background shaped him as a person. He had no vanity, was friendly and helpful, and had a sense of humor. He had vitality, and although he sometimes expressed his viewpoints forcefully, he never bore a grudge. Present and future experimental research at the IPP is based on the foundations von Gierke laid. We will keep him in grateful memory.

Friedrich Wagner
Max Planck Institute for Plasma Physics
Garching, Germany ■