of light. Ney used these instruments to conduct the first scientific experiment in NASA's manned space flight program—a study of the zodiacal light. Flights of these instruments on balloons, Mercury and Gemini missions and two Orbiting Solar Observatories showed that the zodiacal light is highly polarized and is produced by the scattering of sunlight from dust grains. A completely unexpected result was the observation of thousands of terrestrial lightning flashes that showed that there were ten times as many flashes over the land as over the ocean.

In 1963, Ney decided to change from physics to astronomy. He went to Australia to learn astronomy from Hanbury Brown and Richard Twiss, near Narrabri, New South Wales. Upon his return to Minnesota, Ney decided to join the very few other researchers pursuing the emerging field of infrared astronomy. With good students, his own exceptional physical insight and great experimental skills, Ney soon had Minnesota on the frontier of this new research field. He led the construction of the university's O'Brien Observatory with its 30-inch infrared telescope and later helped to design the 60-inch infrared telescope for the Mount Lemmon Observing Facility in Arizona. Ney and Nick Wolf established that silicate and carbon grains, the building blocks of the terrestrial planets, form circumstellar shells around aging stars. As Ney noted at the time, in a cosmology dominated by hydrogen and helium, it was a relief to find the source of the material that forms the terrestrial planets.

After his retirement in 1990, Ney took up yet another field of research, the effect of the radioactivity from radon gas on the atmosphere. He thought that the ionization from radon might account for the difference between the oceanic and continental clouds that had been revealed by the much higher levels of lightning over land.

Ed Ney loved to challenge conventional wisdom and took great pride in finding innovative solutions to difficult theoretical and technical problems. He loved to teach, and several generations of students learned to think deeply about physics under his mentorship.

As unconventional in his dress as in his work, Ney wore red, high-top tennis shoes to many a formal function.

ROBERT D. GEHRZ
THOMAS W. JONES
University of Minnesota
Minneapolis, Minnesota
FRANK M. MCDONALD
University of Maryland at College Park
JOHN E. NAUGLE
North Falmouth, Massachusetts

Mikhail S. Ioffe

Mikhail S. Ioffe, a Russian pioneer in the international research effort to achieve controlled fusion power, passed away in Germany on 14 July 1996, at the age of 78.

M. S. Ioffe will be most remembered for his 1961 experimental demonstration that the gross plasma instability in magnetic fusion experiments can be eliminated with the proper design of the magnetic field configuration. Ioffe's work was performed in a device called a mirror machine. The confinement principle is based on the observation that a single charged particle can remain trapped indefinitely due to the adiabatic invariance of its orbital magnetic moment in a magnetic field. However, gross plasma stability is ensured only in a "magnetic well," in which the magnitude of the magnetic field increases in all directions from the central confinement region. This condition could not be fulfilled by the azimuthally symmetric mirror machines used at the time of Ioffe's pioneering investigations. Ioffe altered the magnetic mirror configuration to achieve the needed magnetic well by adding six conductors parallel to the axis of a simple mirror device, and he experimentally demonstrated that, in this configuration, plasma confinement is greatly improved.

This result was a highlight of the first Conference on Fusion Research held by the International Atomic Energy Agency in Salzburg, Austria, in September 1961. Its importance was immediately appreciated by the fusion community; at a time when many magnetic configurations were plagued by anomalously fast losses, Ioffe presented firm experimental proof that ways existed to eliminate the most dangerous channels of loss.

The magnet configuration used by Ioffe was named "Ioffe bars," a term often found in plasma physics textbooks. Subsequent to Ioffe's work, most research experiments in mirror machines were performed in magnetic well configurations. However, the most important legacy of Ioffe's experiment was the knowledge that the theory that establishes instability criteria indeed works, and that these criteria can be used in many other plasma configurations.

Ioffe was born in Samara, Russia, on 2 September 1917. He studied physics at Leningrad University and received a diploma (the equivalent of a master's degree) in 1940. He served in the Soviet army from 1941 to 1946, and then was a staff member of the Physico-Technical Institute in Leningrad. In 1948 he joined what is today the I. V. Kurchatov Institute of Atomic Energy in Moscow, where he spent the remainder of his professional life. There he was awarded his Candidate's degree (the equivalent of a PhD) in 1953 and a Doctor of Science Degree (an advanced degree indicative of scientific stature) in 1971.

In 1956, he became a leader of a small research group that demonstrated remarkable creativity, often forging paths that other larger groups followed. Some of the outstanding results he obtained, together with his research group, included ways of controlling a plasma "micro-instability" caused by anisotropy of the ion distribution function; comprehensive studies of plasma confinement in toroidal magnetic cusps that included the identification of the plasma instabilities responsible for anomalous transport in these devices; and explanations of the many subtleties in so-called magnetoelectrostatic confinement, a direct predecessor of the tandem mirror.

Although Ioffe was honored by the Soviet government for his accomplishments, his scientific career was clouded by political disfavor. In 1969, at a time when Soviet authorities highly distrusted contacts with Western scientists, he was forced to decline a prestigious American award, the Atoms for Peace Prize. For many years, he was prevented from traveling abroad. Only in 1993 did Ioffe have the opportunity to visit the US, as an honored guest at the annual meeting of the American Physical Society's division of plasma physics.

Throughout his entire life, involvement in physics issues was an essential part of Ioffe's makeup. He was an inexhaustible source of inspiration to his colleagues for new ways to tackle and solve difficult problems. He was beloved, admired, and he will be missed.

HERBERT L. BERK
University of Texas at Austin
THOMAS KENNETH FOWLER
University of California, Berkeley
DIMITRI D. RYUTOV
Lawrence Livermore National Laboratory
Livermore, California

Raymond G. Herb

Raymond G. Herb, an emeritus professor of physics at the University of Wisconsin–Madison and the founder and president of National Electrostatics Corp in Middleton, Wisconsin, died on 1 October 1996 after battling an illness—finally diagnosed as multiple myeloma—for several months.

Born on 22 January 1908 in rural Wisconsin, Herb attended the University of Wisconsin, where he earned a PhB in 1931 and a PhD in 1935, both