als, because infrared experimenters often use mirrors coated with gold or silver by sputtering or mirrors with silver deposited chemically.

Following receipt of his PhD, Strong became a national research fellow at Caltech in 1930–32 and then a research fellow at the 200-inch telescope project at Mount Palomar from 1932 to 1937. He had already perfected the thermal evaporation of aluminum onto glass, which now is so common that every automobile that goes down the street carries headlights made reflective in this way. The method promised to make the new telescope mirror immune to the ravages of oxygen on silver.

Strong came to realize that the solubility of tungsten in aluminum hindered the evaporation in high vacuum of aluminum from tungsten spirals heated by an electric current. He solved the problem by using large wires of tungsten with slender hairpins of aluminum hung suitably on the tungsten helix. In this way he evaporated aluminum onto the 200-inch mirror of the Palomar telescope. (The first mirror to which Strong applied this technique—a 6-inch telescope mirror—is now in the Smithsonian Institution in Washington.)

Strong was careful in giving credit: He always pointed out that L. S. Ornstein first told him that one could evaporate silver thermally to make a silver mirror.

Strong remained at Caltech from 1937 to 1942 as an assistant professor of physics and astrophysics. He then moved to Harvard University to work on infrared projects under the auspices of the National Defense Research Committee. Among other things, he became familiar with the infrared absorption of the atmospheric gases CO_2 and H_2O and the possible absorptive effects of industrial gases in the long line of sight of his experiment on military applications of the infrared part of the spectrum. He remained an authority on these subjects for the rest of his career.

When the war ended, Strong joined the John Hopkins University as a professor of physics from 1945 until 1952. Coming to the home of Henry A. Rowland and his ruling engine for making diffraction gratings, Strong naturally became interested in this device. The result was inevitable: He produced a new ruling engine involving a number of innovations in mechanical engineering, which was used to rule a number of small but excellent gratings.

During this period Strong and his students pioneered the technique of interferometric spectroscopy, familiarly known as "Fourier transform spectroscopy." Around this time Johns Hopkins gave him the title of professor of experimental physics and made him the director of the laboratory of astrophysics and physical meteorology, thus essentially creating a new department for him. He directed this department from 1952 until 1967. During this time he and his students conducted extensive infrared measurements from balloons of the spectral distribution of radiation from planets, including the Earth and the space around it. This group early established itself as authoritative in this specialized field, publishing reports in 1966 and 1967 that summarized perhaps ten years of work in balloon astronomy. One infrared spectrograph aimed at the clouds of Venus finally established that these were composed of CO_2, not of H_2O as had been supposed.

John Donovan Strong

In 1967, as he approached the age of retirement from Johns Hopkins, Strong transferred his work to the University of Massachusetts, Amherst, where he held the title of adjunct professor of physics and astronomy. He retired from there in 1981. Strong published three books in his 50-year career: *Procedures in Experimental Physics* (Prentice-Hall, 1938), *Concepts of Classical Optics* (W. H. Freeman 1958), and *Procedures in Applied Optics* (Marcel Dekker, 1988).

John Strong was president of the Optical Society of America in 1959. During his service on the board of directors and as president, the OSA decided to establish an office in Washington with Mary Warga as executive secretary and to begin the journal *Applied Optics*. These decisions redound to his credit.

JOHN A. SANDERSON
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Philip S. Klebanoff

Philip S. Klebanoff, a prominent researcher in turbulence, died on 2 May 1992, at the age of 73.

Phil was born in New York City. He graduated with a BS from Brooklyn College, where he studied physics, and then joined the National Bureau of Standards in 1942. His early years there were spent contributing, under the direction and leadership of Galen Schubauer, to the rapidly advancing experimental techniques in aerodynamics.

Phil pursued his early projects during a time of great ferment in experimental turbulence research. He and his colleagues used hot-wire anemometers to study both flows in transition and fully turbulent flows. One of the most frequently referenced works in this field is Phil's extensive study of turbulence characteristics in the boundary layer, published as a National Advisory Committee on Aeronautics Technical Note in 1954. His data are still used to establish the validity of current experiments and full numerical simulations in the boundary layer.

Phil later studied the development of waves in the laminar region far beyond the linear range. Using the vibrating-ribbon technique, he established experimentally the complicated three-dimensional nature of boundary layer instability. The three-dimensional waves he discovered are now commonly referred to as Klebanoff modes.

During the early 1960s Phil began what was to be a long and fruitful collaboration with François Frenkiel, a theoretician. Together they explored the fundamental statistical description of turbulence, particularly the smaller scales at high Reynolds number. They made extensive use of the new power of digitized experimental data to examine the nature of the probability distribution of small-scale turbulence.

Phil was invited in 1979 to visit Hokkaido University in Sapporo, Japan, where he lectured, wrote a summary paper on transition and turbulence, and thus received an earned doctorate in engineering.

Phil contributed, in collaboration with his colleagues at NBS, to studies of boundary layer separation and the inflence of roughness on transition and, with his younger colleagues, to studies of magnetohydrodynamics, low-Reynolds-number effects and anemometry instrumentation. Phil's last paper, published just before his death, exemplifies the care, thoroughness and integrity Phil always exhibited and that he inspired in those who worked with him. He will be missed.

L. Patrick Purtell
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Stefan Schmitt-Rink

Stefan Schmitt-Rink, a professor of theoretical physics at Philipps University, in Marburg, Germany, died on 5 May 1992. He was 35 years old.

Stefan was born in Wiesbaden, Germany. He received his PhD from the University of Frankfurt in 1982 for a study of many-body effects in the optical spectra of direct-gap semiconductors. He continued to work with his thesis adviser, Hartmut Haug, and also worked with Phillipe Nozières at the Laue–Langevin Institute in Grenoble, France, in 1983, before joining the theoretical physics department of AT&T Bell Laboratories in October 1985.

Stefan had extraordinary technical skills, vast powers of concentration and uncompromising standards, which he applied to a wide range of problems in solid-state physics. At Bell Labs he made contributions to understanding transport properties of heavy-fermion solids, deciphering mechanisms of anisotropic superconductivity in heavy fermions and developing new approaches to strong electronic correlation in solids. He also made pivotal contributions to models of high-temperature superconductivity and the phenomenology of the normal state in high-T_c superconductors. In addition, he made significant advances in the theory of many-body effects in the optical properties of semiconductors and nanostructures.

Stefan was unusual among theorists in that he interacted strongly with experimenters, especially in the area of optical nonlinearities and electron–electron interaction in semiconductors. His contributions were instrumental in developing the current understanding of many novel phenomena, including the excitonic optical Stark effect, optical rectification, quantum beats, magnetoexcitons and Fermi-edge singularities.

Stefan left Bell Labs in the summer of 1991, eager to start a new theoretical physics group at Philipps. He will be remembered by his friends and numerous collaborators as an intense, generous, warmhearted individual.

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