dimensional Fermi systems, now called Luttinger liquids, differ in essential ways from three-dimensional Fermi liquids. The physics of Luttinger liquids is relevant to one-dimensional conductors and to edge currents in the quantum Hall effect, and has been proposed as relevant to two-dimensional interacting electrons, such as those involved in high-temperature superconductors.

In yet other work, undertaken partly with Kohn, Luttinger demonstrated superfluidity and superconductivity in three-dimensional Fermi systems with purely repulsive interactions. Accordingly, the ground state of such a system was not like that of the Landau–Fermi liquid theory, but had an instability that destroyed the sharp Fermi surface.

Luttinger and Kohn also introduced the concept of anomalous diagrams, which lead to Fermi surface rearrangements.

This period of Luttinger's greatest productivity coincided with what one might call the classic period of many-body theory, in which the presently accepted canon was constructed. Luttinger not only was one of the giant figures of that period but also laid some of the foundations for present-day revisions of that canon.

As a teacher at Columbia, Luttinger received student evaluations that were the envy of his colleagues. Despite a strong aversion to public duties, he was persuaded to serve as chairman of the department from 1977 to 1980. In discussing appointments and promotions, he was always the hardest person to satisfy. If Luttinger approved, his colleagues knew they had made a good choice.

In spite of two decades spent in exile elsewhere, Luttinger was really at home only in New York City, the place of his birth. He was raised in a brownstone on Washington Square and lived nearby in the 1960s.

Luttinger was widely read in English, French and German, had a fine ear for classical music and, in the 1960s and 1970s, experimented with abstract plastic arts. He was a delightful conversationalist with a sense of fun, including a touch of irony, and was the life of every party. Luttinger had a natural love of and affinity for children, both his own and those of his relatives and friends.

Luttinger's work was marked by mathematical power and originality; he had an exceptional ability to formulate theories in appropriate and beautiful mathematical structures. His scientific papers stand out for their clarity and literary quality. With his death, the world of physics, especially condensed matter theory, has lost an original and influential voice that helped to shape the discourse in the second part of this century and will be heard far into the future.

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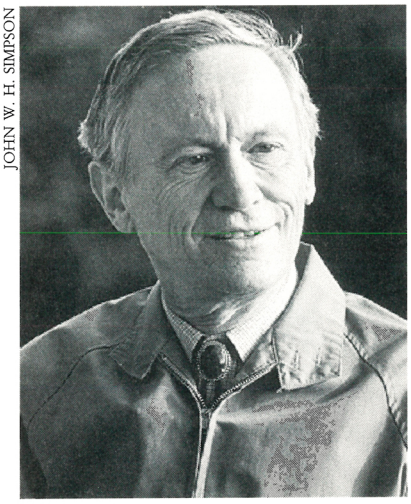
Martin Schwarzschild

Martin Schwarzschild, one of this century's leading astrophysicists, passed away in Langhorne, Pennsylvania, on 10 April, just 10 days after the death of Lyman Spitzer Jr, his close friend and another great scientist.

Born on 31 May 1912, in Potsdam, Germany, Martin earned his PhD in astronomy at the University of Göttingen in 1935. As Hitler's persecution of Jews intensified, he had to leave Germany—initially, for a year in Oslo as a Nansen research fellow. After a brief visit to England, he emigrated to the US in 1937, and became a citizen in 1942.



JOHN W. H. SIMPSON

MARTIN SCHWARZSCHILD

Following relatively short-term appointments at Harvard and Columbia Universities, he accepted a full professorship at Princeton University in 1947, becoming the Higgins Professor of Astronomy in 1951.

Martin arrived at Princeton at the same time as Spitzer, and he made it clear that Spitzer's appointment as the director of Princeton's observatory was critical to his acceptance of the offer of a professorship. In turn, Spitzer made his acceptance conditional on Schwarzschild's. Building on former observatory director Henry Norris Russell's foundations, the two men made Princeton a center of excellence in theoretical astrophysics, as there were few others of their caliber anywhere in the world.

Martin is best known for his work on the theory of stellar evolution. His book *Structure and Evolution of the Stars* (Princeton University Press, 1958) became the classic text in this field of research. Among his many contributions, perhaps the most fundamental were understanding the structure of red giant stars and using the results to determine stellar ages.

He pioneered the use of computers for calculating numerical models of the stars. As early as 1941, he published the paper "Automatic Integration of Linear Second-Order Differential Equations by Means of Punched-Card Machines." A few years later, he was one of the first to recognize the potential of the early computers developed at Princeton by John von Neumann, and to use them for research.

One of the most intractable theoretical problems in stellar structure was—and still is—explaining the inefficiency of convection just below the stellar atmosphere. Martin recognized that progress could best be made by obtaining very high angular resolution images of the Sun—specifically, by measuring the scale of the turbulent eddies known as solar granules. The fact that all telescopes on the ground have their images blurred by Earth's atmosphere led Martin to develop Stratoscope I in the 1950s and Stratoscope II in the 1960s. These were balloon-borne telescopes with diameters of 12 and 36 inches, respectively, that provided diffraction limited images of the Sun and various other objects, including the nucleus of the nearby Andromeda galaxy. The high resolution of the images demonstrated the scientific potential of observations made from above the atmosphere and paved the way for the Hubble Space Telescope.

Although Martin had always been interested in the structure of galaxies, it did not become his primary area of research until after his retirement in 1979, when he developed a novel and very powerful method of constructing numerical models of stellar systems. His was the first clear demonstration that elliptical galaxies are typically triaxial objects, rather than oblate spheroids. This finding opened up a broad new field of modern theoretical and observational research.

Martin was also very active in public affairs, serving for several years as the vice president of the International Astronomical Union and president of the American Astronomical Society. In

particular, he initiated and led an important reorganization of the AAS and its leading scientific publication, the *Astrophysical Journal*.

His impact on astrophysics was recognized with numerous awards and prizes. The last of them, the National Medal of Science, was awarded to him posthumously by President Clinton.

Martin's clarity of thinking was legendary, as was his ability to summarize and explain in just a few sentences any recent scientific development. At the weekly colloquium at Princeton, he often summed up the lecture for the audience so masterfully that it was not uncommon for his summary to be more lucid and informative than the hour-long lecture that preceded it.

He was also known for having thought through an impressive range of scientific, science policy and social issues. When asked a difficult question by one of his colleagues—how should this or that be addressed, handled or resolved—he always had a well-reasoned, compassionate and sound answer. If there really are wise old men, warm and humane, Martin was certainly one of them. With his and Spitzer's departure, life at Princeton will never be the same again.

Bohdan Paczynski
Princeton University
Princeton, New Jersey

Eugene Ghiron Fubini

Eugene Ghiron Fubini died in Brookline, Massachusetts, on 5 August after a lifetime of making numerous contributions to military and civilian technology and of consistent dedication to the security and prosperity of the US.

Fubini, whose father was the well-known mathematician Guido Fubini, was born in Turin, Italy, on 19 April 1913. He received his *laurea* (doctorate) in physics from the University of Rome in 1933 under the guidance of Enrico Fermi.

The brilliance of Fermi, whom Fubini regarded as "the smartest person I've ever known," persuaded him—wrongly—that physics was too difficult for him to excel at. Consequently, Fubini turned to engineering—specifically, radio and electronics. He worked at the National Institute of Electrotechnics in Rome and then, after emigrating to the US in 1939, at CBS as an engineer.

When the US entered World War II late in 1941, Fubini (although technically an enemy alien) joined Harvard University's secret Radio Research Laboratory, which was responsible for the R&D of electronic intelligence and countermeasures. He became a scientific consultant and technical observer for the US Army and Navy in the European theater of operations. His work involved electronic reconnaissance and jamming for the invasions of Italy and southern France, as well as combat missions for the Eighth Air Force. Thanks to his skill, courage, enthusiasm and engaging personality, he established a lasting rapport with military personnel of all ranks.

When the war ended, Fubini joined what is now AIL Systems, Inc, a subsidiary of Eaton Corp, in Melville, New York. For 15 years, he was involved in the development of a wide variety of electronic intelligence and reconnaissance systems and was largely responsible for AIL's rapid growth in the late 1950s and early 1960s.

In March 1961, Fubini joined the Office of the Secretary of Defense as deputy director of defense research and engineering (R&E) for research and information systems, beginning an intense and dedicated association with OSD that lasted in various forms for over 30 years.

In June 1963, he became principal deputy director of R&E and an assistant secretary of defense. In those roles, he oversaw the intelligence agencies of the Department of Defense (DOD), as well as the programs and budgets for command, control and communications. His contributions over the following decades to what has become known as C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance)—the brain of modern military capability—have not been equaled.

In June 1965, he returned to the private sector, joining IBM Corp as a vice president responsible for (among other activities) the research division and the advanced systems development division. He was an early advocate of the development of the personal computer.

After leaving IBM in April 1969, he became a private consultant to industry and government for the rest of his career, during which he continued his leadership role in advising various elements of DOD and other government agencies, as well as NATO. He helped to create many advisory committees, whose work went beyond technical contributions to include military tactics and national strategy. He also served as a director on several corporate boards.

Beyond his brilliant and broad intellect, Fubini's many friends and associates valued his infectious and inspiring spirit, his unpretentious and ebullient manner and his commitment to excellence. He loved the US and its armed forces, which returned the affection. He was always volunteering to help those he knew—or those he didn't know, but who had heard of him and asked for help—in finding jobs or in solving technical or personal problems. No wonder so many of us loved him, miss him and will remember him for a very long time.

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Earl K. Hyde

Earl K. Hyde, a senior scientist and deputy director emeritus at Lawrence Berkeley National Laboratory (LBNL), died in Berkeley, California, on 3 March at the age of 76.

Earl was born in Rossburn, Manitoba, but grew up in Joliet, Illinois. After earning a BS in chemistry from the University of Chicago in 1941, he joined the Manhattan Project at Chicago, where he distinguished himself by characterizing the chemical properties of a number of compounds of uranium, plutonium and protactinium.

In 1946, Earl received a PhD in chemistry from the University of Chicago and then joined the staff of Argonne National Laboratory, where he studied the nuclear properties of new isotopes of uranium and plutonium. In early 1949, Glenn Seaborg invited him to spend a year at the Radiation Laboratory of the University of California, Berkeley. That stay of one year at what became LBNL was to lengthen to almost four decades.

Earl's first studies there were on the chemical—and particularly the nuclear—properties of heavy element iso-

Earl K. Hyde