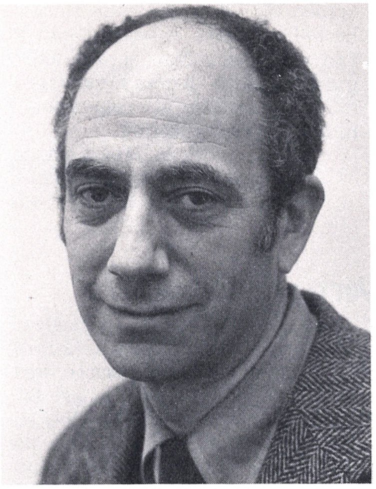

Allan M. Sachs

man of the physics department at Columbia University from 1967 to 1971 and had been associate director of the Nevis Laboratory since 1972. He had also been director of the Science Honors Program for gifted high school students since 1968, and he received Columbia's Great Teacher Award in 1977.

Sachs was born in New York City on 13 July 1921. After earning his BA from Harvard in 1942, he joined the Army Air Force and became the commanding officer of a glider-borne radio and radar squadron in Burma. After World War II he returned to Harvard, where he was awarded his PhD in 1950 for studies of spin relaxation times in ammonium halides, work done with Edward Purcell soon after the discovery of nuclear magnetic resonance.

In the early 1950s Sachs collaborated with Jack Steinberger and others on measurements of the properties of pions, using the external pion beams that had lately been made available by the Columbia Nevis cyclotron. Sachs and his colleagues determined pion–nucleus total cross sections for various elements, observed in coincidence the two gamma rays from neutral pion decay, made the first observation of the internal conversion of one of the gamma rays from neutral pion decay, and carried out extensive measurements of the differential cross section of charged pions in hydrogen at energies below the $(^3/_2, ^3/_2)$ resonance.

In 1957 Sachs began his work with muons. In that year he and his colleagues made the first measurement of the muon's magnetic moment with sufficient precision to see deviations from the value predicted by the Dirac equation. The experiment used a magnetic-resonance technique, and Sachs's experience with nmr and condensed matter effects played a major role. In later experiments at the Nevis cyclotron, Sachs and his coworkers were the first to use muons to study the properties of solids. They demonstrated a correlation between the depolarization exhibited by positive muons stopping in the target and the electronic characteristics of the target. In another collaboration, Sachs improved the limit on the branching ratio for $\mu \to e + \gamma$ by two orders of magnitude. In the early 1960s he and his student John Peoples produced at the Nevis Laboratory what remains the most precise measurement of the Michel parameter, which characterizes the shape of the muon decay spectrum.

Sachs visited CERN at its inception and investigated isospin conservation by studying the reactions $p + d \to \pi^+ + H^3$ and $\pi^0 + He^3$ on CERN's 600-MeV synchrocyclotron. As the senior member of one of the first experimental groups at CERN, Sachs significantly influenced the style and scientific level of this emerging laboratory.

In recent years Sachs was engaged in a Brookhaven experiment to measure with great precision vacuum polarization in quantum electrodynamics by observing laser-induced transitions in muonic helium. He pursued this experiment with characteristic energy and resourcefulness, developing a pulsed, stopping muon beam with higher instantaneous intensity than was previously available.

Sachs devoted much of his time and energy to teaching. As a member of the Commission on College Physics in the 1960s and of the National Science Foundation's physics advisory committee in the 1970s, he helped formulate an approach to introductory physics emphasizing lecture demonstrations and extensive laboratory work. Sachs took particular pride in the spark chambers and precision air troughs that he had designed and built for undergraduate classes at Columbia. To all of his teaching he brought enthusiasm, vitality, knowledge and a warm interest in his students.

Sachs was an inspiration to his colleagues and students. He lived according to the highest standards, both in scientific work and in human conduct. He was modest and rejected all pretense and superficiality. His warmth and concern made working with him a great pleasure. Students with intelligence and promise delighted him and he spared no effort to help them on the path to a scientific career. He will be long remembered and greatly missed.

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Guido Beck

Guido Beck, who began his scientific career in Europe during the golden age of quantum mechanics, and after taking refuge in South America during the Second World War became one of the founding fathers of theoretical physics in Argentina and in Brazil, died on 21 October 1988.

Beck was born in 1903 in the Bohemian town of Reichenberg (now known as Liberec); he kept the Austrian nationality. He took his PhD with Hans Thirring at the University of Vienna in 1925. In the next few years he was an assistant professor, first at Bern University, then at the University of Vienna.

In 1927 Michele Besso, who had met Beck at Bern, mentioned in a letter to Einstein a paper that Beck had sent him on the theory of the photoelectric effect "à la Schrödinger." In this paper Beck applied what would now be called the semiclassical theory of radiation (quantizing the atoms, but not the electromagnetic field) to show that several features of the photoelectric effect, including Einstein's relation, followed from Schrödinger's equation. This result, independently derived by Gregor Wentzel at the same time, was rediscovered much later and has played a significant role in discussions of the foundations of quantum optics.

In a series of papers that were published from 1928 to 1930, Beck analyzed the systematics of isotopes, trying to draw inferences about nuclear structure from observed regularities. This bold attempt to apply the new quantum mechanics to the nucleus was hampered by its very earliness: The first paper was published four years before the discovery of the neutron. In that paper Beck stated, "The simplest assumption, by analogy with the electronic structure of the atom, is that nuclei are also built up by the formation of successive shells." Eugene Wigner and Merril Eisenbud have referred to these papers as the earliest precursors of the nuclear shell model.

By 1929 Beck had moved to Leipzig, where he worked as an assistant to Heisenberg for the next three years. Beck's stay at Leipzig was interrupted twice, for visits to the Cavendish Laboratory and to Bohr's Institute of

Guido Beck

Theoretical Physics in Copenhagen. While at Cambridge Beck coauthored with Hans Bethe and W. Riezler an article that became one of the most celebrated pranks in physics—a short note on the "Quantum Theory of the Zero-Point Temperature," published in *Naturwissenschaften* in 1931, parodying Arthur Eddington's speculations on the fine-structure constant.

During this period Beck worked on potential field models of atomic and nuclear scattering and reactions. Stressing the analogy with optical multiple-beam interference in thin plates, he analyzed the Ramsauer effect and resonance scattering and he explained anomalous alpha-particle scattering.

Between 1932 and 1934 Beck lectured at the German University in Prague. Influenced by Bohr's speculation that the continuous electron spectrum in beta decay might be a manifestation of energy nonconservation in nuclei, Beck, together with his student Kurt Sitte, formulated a theory of beta decay based on pair production within the nucleus followed by positron capture violating energy–momentum conservation. This approach was superseded by Enrico Fermi's theory.

When instances of racial persecution began in Prague, Beck accepted an invitation to serve as a visiting professor at the University of Kansas (1934–35). There, with his student Lee Horsley, Beck explained the enhancement in the capture rate of slow neutrons that Fermi had recently observed, arriving independently at the famous $1/v$ law that was being derived at the same time by Fermi, by Bethe, and by Francis Perrin and Walter Elsasser.

In 1935 Beck moved to the Soviet Union, where Jakov Frenkel had offered him a chair at Odessa University. But two years later, when foreigners began being viewed as undesirable, Beck left the Soviet Union and, with the help of Paul Langevin, eventually settled in France. There he worked first at the Institut Henri Poincaré in Paris and then at the Institut de Physique Atomique in Lyon. After the fall of France to Germany, Beck stayed in Lyon for some time, helping other refugee physicists. In 1942 he moved to Portugal, and in 1943 he accepted an invitation from Enrique Gaviola to join the Cordoba Observatory in Argentina. He spent the rest of his life in academic positions in South America. In 1952 he became a professor at the Brazilian Center for Physics Research in Rio de Janeiro. He returned to Argentina in 1963 to work at the Physics Institute in Bariloche, which is now named for José Antonio Balseiro, a former student of Beck's. Beck also spent a few years as a visiting professor at the University of São Paulo and at the Federal University of Rio de Janeiro. In recent years, he was a frequent visitor to CERN, to the University of Vienna and to the Technische Hochschule in Darmstadt.

Beck's students in South America worked in a variety of fields: classical and quantum optics, quantum scattering theory, quantum field theory and others. It is difficult to do justice to his outstanding contribution to the development of theoretical physics in Argentina and Brazil. Fighting against huge difficulties, he formed a large number of physicists while upholding the highest academic standards.

One can apply to Beck the words he himself wrote in 1954 about Richard Gans, one of his predecessors in Argentina: "When I think about his work as a pioneer, I often feel bitterness. However, it is also a glorious chapter in a great development: a whole lifetime spent by a strong personality in an isolated outpost, sustained solely by his convictions and his courage, fighting for our civilization."

Beck's own personality, full of liveliness and charm, was unforgettable. He always referred to his students as his "children." How he dealt with them is well illustrated by these memories of one of his Odessa students:

> After the seminars, the students often walked with Beck all the way to his home, about an hour and a half's walk. Along the way, we discussed the latest developments in physics. These discussions invariably finished at his home. We sat on the floor, since he did not have enough chairs, and the discussions proceeded until very late. It was a wonderful time, and we all remember him with great affection.

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Michael Grace

Michael Anthony Grace, a nuclear physicist at the University of Oxford and a fellow of the Royal Society, died suddenly on 17 May 1988, at age 68. He was a fellow of Christ Church College at Oxford, and had been its senior censor (head of academic affairs) for a five-year term. He had also been a reader in nuclear physics at the university.

Grace was a member of the team that achieved the first nuclear orientation by cryogenic means. In a paper published in *The Philosophical Magazine* in 1953, the Oxford group reported the observation of anisotropy in the gamma rays emitted from Co^{60} in fields of a few hundred oersteds at temperatures between a few millikelvins and 1 kelvin.

Regarded as an interesting but not especially useful result at the time, it is now recognized as the key precursor to many investigations, including the famous Wu–Ambler experiment on parity violation in beta decay.

Grace was always interested in the interaction of nuclei and atoms. He made pioneering measurements of nuclear magnetic moments using the intense magnetic field of an unpaired inner electron whose partner had been stripped away in the same process that excited the nucleus. He was one of the first to use movable stoppers to measure the lifetimes of short-lived nuclear states by observing the Doppler shifts of emitted gamma rays. He also did a number of experiments measuring properties of the lower excited states of Fe^{57}, now one of the most useful isotopes in science.

Many American visitors to Oxford or, in the early days, to Harwell, became Grace's friends. (We were among them.) Discussions of physics with Michael Grace were always profitable. His innocent-sounding questions often contained sharp insights, but even his keenest criticism was always counterbalanced by his fundamental kindness, his cheerful optimism and his warm sense of humor.

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