particles). His role as a pioneer and founder of high-energy physics was widely noted by, among others, Ernest Rutherford, Werner Heisenberg, Paul Dirac and Frédéric Joliot-Curie.

During the 1930s electromagnetic cascade theory was created to explain cascade multiplication of electrons, positrons and gamma quanta based on QED. Skobeltsyn was the first to use the energy conservation law to determine the quantitative relation between the number of particles at a maximum of the electromagnetic cascade and the energy of the primary particle inducing the cascade. This relation was decisive for the creation of the quantitative cascade theory and also formed the conceptual basis of a novel experimental technique, the ionization calorimeter or full-absorption spectrometer method.

In the late 1930s Skobeltsyn went to work at the Lebedev Physical Institute of the Soviet Academy of Sciences in Moscow. There he started a series of investigations into the extensive air showers that are the most striking manifestation of the cascade-producing power of superhigh-energy (10^5–10^{11} GeV) cosmic rays.

Experimental studies of different characteristics of extensive air showers by Skobeltsyn and his coworkers in the 1940s demonstrated that these showers develop not by the well-known electromagnetic cascade process, but by a nuclear cascade process accompanied by multiple hadronic generation. This discovery radically changed the existing concept of cosmic rays as particles of exclusively electromagnetic origin and underlies the modern conception of cosmic rays and their interactions with matter. More accurate investigations with accelerators in the succeeding decades confirmed the main characteristics of nuclear cascade processes at high and superhigh energies. The results of Skobeltsyn's school also were significant in the development of gamma-ray astronomy.

As the founder of the Institute of Nuclear Physics at Moscow State University and its director from 1946 to 1960, as well as the director of the Lebedev Institute from 1951 to 1973, Skobeltsyn greatly influenced his close disciples and many others by guiding their scientific work and generously sharing his ideas. His activities promoted the vigorous development of various trends in nuclear physics, including the creation of new accelerators, and the development of quantum electronics.

Skobeltsyn's interests ranged widely, from elementary particle physics to the intricate problems of general relativity and of the electrodynamics of continuous media. In each of these areas he left his mark, and his scientific papers and books contain comprehensive analyses of the problems in question, along with original approaches to their solution.

In the last years of his life Skobeltsyn took a lively interest in experiments in which narrow e^+e^- resonances were observed in collisions of relativistic nuclei. He felt a connection between these and his own experiments of the late 1930s in which he had observed the anomalous scattering of electrons emitted from radioactive sources. The results of the experiments on relativisitic nuclei held his keen interest until the last day of his life.

With Skobeltsyn's death, science has lost an eminent experimenter and theorist. His disciples have lost a wise, kind and considerate teacher. His friends and colleagues have lost a great man, one who was very friendly and sympathetic and who apprehended and valued not only science but also other lofty manifestations of the human soul.

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David Harker

David Harker

David Harker died from complications due to heart disease and pneumonia on 27 February 1991, after a long illness. He was 84 years old.

Harker received his undergraduate degree in chemistry from the University of California, Berkeley, in 1928 and his doctorate in x-ray crystallography from Caltech in 1936, under the guidance of Linus Pauling. Harker's doctoral dissertation contained his first major contribution to the science of x-ray crystallography, an extension of A. Lindo Patterson's famous paper of 1934. Patterson had shown that the positions of the maxima of the Fourier series whose coefficients are the corrected intensities of the diffraction peaks obtained when x rays are scattered by a crystal coincide with the collection of the interatomic vectors in the crystals. What Harker saw was that, because atoms are related to one another by elements of crystallographic symmetry, scattering would produce peaks in the Patterson function only in certain planes or along certain lines determined by the crystallographic space group. This insight greatly simplified the interpretation of the Patterson function and facilitated the determination of crystal structures from x-ray diffraction data. This early contribution of Harker's influenced the development of x-ray crystallography for the next 50 years, and it still finds application in structural analysis, particularly of crystals containing a small number of heavy atoms.

Harker's second major contribution came in 1947 when he and John Kasper, working at the General Electric Research Laboratory at Schenectady, New York, discovered the first inequalities among the crystal structure factors. The structure factors are complex numbers, only the magnitudes of which can be routinely determined from the observed x-ray diffraction intensities. They are the key to the determination of crystal structures, because the positions of the maxima of the Fourier series whose coefficients are the structure factors (as distinct from the observed x-ray intensities) coincide with the atomic position vectors. The importance of the Harker–Kasper inequalities lies in the fact that they relate the complex structure factors to their magnitudes and in this way impose a limitation on their values. This result made possible the routine determination of the molecular structure of decaborane, $B_{10}H_{14}$, a problem that had previously defeated Harker's and Kasper's best efforts. More importantly, this work of Harker and Kasper served as the inspiration for the development of a major branch of x-ray crystallography, the so-called direct methods, which have made possible the routine determination of tens of thousands of molecular structures.

Harker next moved to the Polytechnic Institute of Brooklyn, where he was director of the Protein Structure Project from 1950 to 1959. His goal there was to determine the molecular structure of the protein ribonuclease. However, Polytechnic decided that work on the structure of proteins was inappropriate for an engineering institute. Thus in 1959 Harker and his group moved to the biophysics department of the Roswell Park Memorial Institute in Buffalo to continue their work. In the meantime Harker, following some earlier work of Johannes Bijvoet, had perfected the method of multiple isomorphous replacement. To this end he had obtained, in addition to crystals of the native, that is, original, protein of primary interest, crystals of at least two isomorphous derivatives obtained by infusing a small number of heavy atoms into the native protein without altering the primary structure. Though diffraction data from this family of isomorphous crystals would suffice for the determination of the structure of the native protein, it took Harker and his team many years to overcome the innumerable obstacles that blocked their path. It was not until 1967 that they finally worked out the main features of the ribonuclease molecule.

After his retirement from Roswell Park in 1976, Harker continued his crystallographic studies as a research scientist emeritus at the Medical Foundation of Buffalo. He worked there until the end of his life making important contributions to the theory of colored space groups, an aspect of crystallographic symmetry that he found particularly fascinating.

David Harker was an old-fashioned gentleman with old-fashioned qualities—reserved, almost shy, and honestly courteous and unpretentious. He was concerned particularly in his later years with being helpful to younger colleagues, and for them he served as a role model and teacher. He was one of the greatest crystallographers of this century, but he was never patronizing to others, young or old. He was kind and gentle and, at the same time, a man of uncompromising honesty and integrity. He was a tireless seeker of the truth wherever he could find it, and in this quest he was more successful than most. His passing leaves a large empty space on the crystallographic scene that will not soon be filled.

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William Parrish

William Parrish, one of the foremost figures in x-ray instrumentation and x-ray powder diffraction, died on 18 March 1991 after suffering a stroke. He was 76 years of age. Parrish was best known as the inventor of the modern x-ray powder diffractometer and for his extensive research to improve the technique of powder diffraction.

Bill received a BS degree in mineralogy from Pennsylvania State University in 1935 and a PhD degree in physics from MIT in 1940. He taught briefly at Penn State until late 1942, when he was called to Washington by the Office of the Chief Signal Officer to organize an effort to support expanded wartime production of quartz crystal oscillator plates. These plates were used in a variety of military electronics that required precise timing and frequency control. Parrish and other scientists set out to study and to improve upon the inefficient techniques then employed to produce the final cut and oriented crystals. They devised methods for virtually all aspects of production, developed new instruments and provided lecture demonstrations and training for thousands of wartime personnel in the use of x-ray and crystallographic methods. Parrish developed a special goniometer for checking crystal orientation that had many of the elements of the future x-ray powder diffractometer, namely a rapid measurement of the Bragg scattering angles with high precision requiring no calculation or interpretation. This method, which was the first use of x-ray diffraction as an integral part of mass production, and others that Parrish and his coworkers developed helped increase the production of quartz oscillators 300-fold by 1944, reducing the cost of these devices in the process.

In 1943 Parrish joined the Phillips Laboratories in Briarcliff Manors, New York, where he organized the x ray and crystallography section. He served as chief of this section for the next 25 years. Parrish was responsible for developing many of the instruments and methods that became commercial products widely used for powder or polycrystalline x-ray diffraction analysis. His most important achievement was the invention of the modern x-ray powder diffractometer, whose x-ray optics provided rapid, high-resolution Bragg-angle diffraction with good profile shape. It is the basic instrument for x-ray diffraction of polycrystalline materials.

In 1971 Parrish joined IBM's research division in San Jose. He became manager of the crystallography and microstructure group, which was set up to develop x-ray and electron-beam methods for materials characterization, particularly for thin films. This group did pioneering work on the use of minicomputers for the automated collection and analysis of x-ray powder diffraction data. Specifically, they made many contributions to line-shape analysis and rapid search/match methods. By demonstrating the importance of crystal orientation on diamond tool life, Parrish also helped in the manufacture of magnetic disk substrates by diamond machining.

In 1977 Parrish became interested in the use of synchrotron radiation as a source for x-ray diffraction experiments, and in collaboration with Michael Hart he began such studies at the Stanford Synchrotron Radiation Laboratory. The two developed diffraction topographic methods for the study of epitaxially grown single-crystal films and instrumentation for high-resolution x-ray diffraction of powders and thin films.

A prolific author, Parrish published papers ranging from the entry on x rays in the *Encyclopaedia Americana* to chapters on x-ray powder diffraction in the *International Table of Crystallography.* Parrish organized and edited the first *World Directory of Crystallographers* and was chairman of the committee that set up the *Journal of Applied Crystallography.*

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John P. Vinti

John Pascal Vinti passed away on 28 September 1990 in Boston, at the age of 83.

Vinti's scientific career was notable for its creative versatility. At first a theoretical physicist, Vinti made important contributions to atomic and molecular physics as well as to related fields, and he published papers in physics, mathematics and engineering.

Vinti entered MIT at the age of 15 and earned a BS degree in mathematics in 1927. He earned his doctorate in physics at MIT in 1932. Between 1932 and 1934, while at the University of Pennsylvania, Vinti continued work that he had started in graduate school on the continuous absorption spectrum of helium.

With the advent of World War II, Vinti moved to the Ballistics Re-