# Dr. William Parrish
# 1915 - 1991

William Parrish, well known for his contributions to X-ray instrumentation and X-ray powder diffraction, died in San Jose, California on 18 March 1991 after suffering a stroke eleven days earlier. He was 76 years of age.

Parrish was born in Philadelphia in 1915. He received his B.S. degree in mineralogy from The Pennsylvania State University in 1935 and his Ph.D degree in physics in 1940 from the Massachusetts Institute of Technology. He returned to Penn State to teach until he was called to Washington, D.C. in 1942 by the Office of the Chief Signal Officer to participate in a project on quartz oscillator plates for wartime production. In 1944, Bill joined Philips Research Laboratories in Briarcliff Manor, New York, where he organized the X-ray and Crystallography Section and served as its Chief for the next 25 years. From 1968 to 1970, he served as Chief of the Materials Characterization Branch of the NASA Electronics Research Center in Cambridge, Massachusetts. In 1970, he joined IBM Corporation as Manager of Crystallography and Microstructure at the Research Center in San Jose. He was still employed by IBM at the time of his death.

The combination of mineralogy and physics led Parrish into a career of perfecting instrumentation for the studies of crystals. During his tenure with the Signal Corps, he worked on the processing of quartz for communication equipment which was vital to the war effort. All quartz plates at this time were cut from natural crystals imported from Brazil. The war required the production to be increased from approximately 50,000 plates to tens of millions per year. This increase was accomplished by improving both the efficiency of the cutting of the blanks from the original crystals and in the orienting and lapping of the plates to final specifications. Parrish developed a special goniometer for checking crystal orientation and being able to measure the orientation of the quartz to minutes of arc in less than 15 seconds of time; these special goniometers, operated by persons unskilled in crystallography, permitted production schedules involving hundreds of thousands of measurements to be made each day – an unprecendented performance. This instrument was the first X-ray diffraction apparatus to be used in industrial production and had many of the elements of the diffractometer he was to develop later. As a result of the accomplishments of Parrish and his co-workers, the production of oscillator plates reached 30 million per year by 1944. Although this project was primarily for the war, the result decreased the costs of quartz plates and opened the way for quartz applications in modern electronic instruments. For these efforts, Parrish received a special War Department Citation.

At Philips Laboratories, Parrish specialized in X-ray diffraction instrumentation. Without a doubt, his most well-known accomplishment was the development of the powder diffractometer for which he received a patent in 1947. Although others had suggested the idea of using electronic detectors instead of film as the principal sensor for powder diffraction experiments, previous attempts were limited by low intensity and poor resolution. Parrish developed a highly reliable device which improved the X-ray optics to achieve both increased intensities and high resolution. The instrument was quickly accepted as the basic instrument for the diffraction laboratory and was one of the most successful products for Philips Electronics Instruments. An estimated 15,000 diffractometers of the Parrish design are in use today in diffraction laboratories throughout the world making it the most widely used X-ray crystallographic instrument.

Parrish devoted most of his efforts at Philips Laboratories toward understanding and improving the diffractometer. Many new accessories and alignment tools were designed, but the basic instrument was so well thought out that the optics were little modified over the years. Parrish and associates developed improved electronics for the detection and discrimination of the X-ray beam and applied these developments to the diffractometer system. Innovations included the introduction of scintillation and proportional counters with pulse-height discrimination and high linearity and peak-to-background characteristics. He also developed diffractometers with transmission optics, improved methods of alignment and calibration, and the use of vacuum paths for soft X-rays. Through the American Crystallographic Association and the International Union of Crystallography, he organized round-robin inter-laboratory projects on the measurement of intensities and accurate d-spacings. While at Philips Laboratories, Parrish was the author of over 100 publications on instrumentation, many of which are included in his book "X-ray Analysis Papers" (Centrex Publishing Co., Eindhoven, 1965).

Toward the end of his tenure at Philips, Parrish became involved in the lunar research projects. He designed a diffractometer for incorporation in an un-manned spacecraft for determining the compositions of lunar soils at the landing site. Although this instrument never flew, he continued his association with NASA when he left Philips and joined the NASA Electronics Research Center. In this position he became very interested in materials characterization.

At the IBM Research Center, Parrish was involved with the characterization of electronic materials, particularly thin films. He and his co-workers also did pioneering work on using microcomputers in the automation of X-ray diffraction instrumentation and in data collection and analysis. One of the products of this study was to improve methods for deconvoluting diffraction peaks and obtaining accurate data for characterization and identification. This effort led to several IBM products and an IBM Outstanding Contribution Award.

In 1977, Parrish began the last stage of his career when he became interested in the use of synchrotron radiation as a source for the X-ray diffraction experiments. In collaboration with Michael Hart, Parrish developed topographic methods for examining epitaxially-grown single-crystal films. More recently, he was working on instrumentation for precision measurement for accurate lattice parameter determinations. He was active in this work at the time of his stroke.

Parrish was the author of more than 300 publications. In addition to many technical papers, he contributed chapters to the Encyclopedia Americana and the International Tables of Crystallography. He was very active in national and international scientific organizations. He was Secretary-Treasurer of the Crystallographic Society of America from 1945 to 1949 at the time when it was helping to organize the American

Crystallographic Association and was on the ACA Apparatus and Standards Committee from 1950 to 1951 and 1988 to 1990 and Chairman of the Applied Crystallography Special Interest Group in 1979. He was also a member of the Joint Committee for Chemical Analysis by X-ray Diffraction Methods (the forerunner to the International Centre for Diffraction Data). He was the Secretary of the U.S. National Committee on Crystallography 1954-1956 and 1968-1970. He was a Fellow of the Mineralogical Society of America.

Parrish was involved at the start of the International Union of Crystallography as a member of the Provisional International Crystallographic Committee from 1946 to 1948. This committee was a forerunner of the IUCr Executive Committee and saw the establishment of the Commission itself. He organized and edited the first World Directory of Crystallographers and was Chairman of the IUCr Committee that set up the Journal of Applied Crystallography. He was Chairman of the IUCr Commission on Crystallographic Apparatus from 1957 to 1963 and a member of the IUCr Commission on Crystallographic Data from 1951 to 1954.

In 1987, Parrish was awarded the J. D. Hanawalt Award of the International Centre for Diffraction Data for his contributions to powder diffraction. In the same year, he also received the first C. S. Barrett Award of the Denver Analytical X-ray Conference.

The best way to describe Parrish as a person is to quote long-time associate Joshua Ladell in "Crystallography in North America" (D. McLachlan and J. P. Glusker, American Crystallographic Association, 1983). "While at Philips Laboratories, Parrish was an indefatigable researcher. In his passion for understanding and innovation, he was uncompromising in his quest for the truth. To Bill research was spelled with a capital R and Science with a capital S. In choosing subordinates he sought out talented people and encouraged the best from them." "As a boss, Bill Parrish was kind and compassionate. The morale of the section was always high. The pace and intensity of work at this time were primarily set by personal example." His wife Lillian, an accomplished concert pianist in her own right, said that it was wonderful that Bill could continue his research right up to his death.

My personal contacts with Bill were many. In addition to technical discussions, I always kept him up-to-date on the football activities of Penn State including supplying him with the Fall schedule announcements when they appeared. I remember his reaction when I informed him of his selection for the Hanawalt Award. He was truly surprised and deeply touched that his colleagues chose him from among so many qualified recipients. Beneath his apparent serious personality was a very humble person. We will miss him.

In keeping with the tradition of *Powder Diffraction* of reprinting significant early articles, this issue contains some papers telling the story of the powder diffractometer including the Parrish contribution that made the concept a reality.

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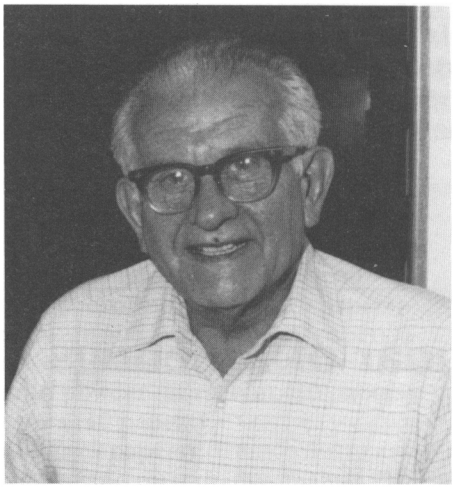

*William Parrish*