Obituary

Robert Rathbun Wilson (1914–2000)

When visiting Fermilab, the site of the massive synchrotron at Batavia in Illinois, one passes through a living memorial to one of the great men of physics — Robert R. Wilson, who died on 16 January at the age of 85. His art, architecture and love of the environment, and his integration of the machines of high-energy physics with nature and with the scientists that use them, are evident everywhere. The Fermilab site represents the ultimate synthesis of his many talents. Wilson's death marks the end of an era when a few giants led us down a path lined with Nobel prizes.

Scientifically, Wilson's greatest contribution was in developing and building accelerators of ever-increasing energy. An accelerator furnishes a 'microscope' for looking inside protons, and the higher the energy of the machine, the finer the detail that can be seen. Wilson's early work as a graduate student at Berkeley with E. O. Lawrence involved cyclotrons working at 20 megaelectron volts (MeV) and his final machine at Fermilab, the Tevatron, is working at 1 TeV (10^{12} eV). The fruits of his drive for higher energy have been the discoveries of the two heaviest quarks, the b and top quarks, at the Tevatron. This facility is used by thousands of physicists and will continue to be the highest energy machine until the Large Hadron Collider comes on line at CERN.

Wilson's love of accelerators began at Cornell University in 1947. Several 300-MeV electron synchrotrons were being built by universities; one was at Cornell. The energy was both fortunate and unfortunate. The threshold for making the newly discovered pi mesons using an electron synchrotron was 150 MeV. These mesons form the glue that holds nuclei together, and there was even an indication that gamma rays could excite them to resonance levels within the proton. The idea that the proton had a resonance was pretty heady stuff — it meant that the proton had structure! The proof required a machine that could go to energies above 300 MeV. At Caltech we had a new machine that could go to 500 MeV, constructed from the quarter-scale model of the Bevatron that had been given to us by E. O. Lawrence. So we were ahead for a while (but not for long!).

In 1952, E. Courant, M. S. Livingston and H. Snyder invented a technique for strong focusing of particle beams. Wilson saw that this discovery promised higher energy and cheaper machines, because the magnets would have a much smaller aperture. He built the first working model of a strong-focusing synchrotron, which verified the theory and showed the promise of this new technology. Wilson continued to push accelerator technology at Cornell, and as a result the Cornell Laboratory of Nuclear Studies continues to be a unique university-centred high-energy physics laboratory.

Artist, architect, humanitarian and physicist

Wilson's pioneering work at Cornell made him the ideal leader in 1967 for the newly proposed proton synchrotron to be built at Batavia, Illinois. This project was not without controversy. There was a more conventional design for the machine and it was suggested that Wilson had no experience with the more complicated proton accelerators. Nevertheless, he boldly proposed an innovative design. Although the design energy was 300 GeV, I'm sure that it never entered his mind that this would be the final energy. He succeeded in building the original machine and the laboratory to support it, and still had $10 million left. Moreover, the machine routinely operated at 400 GeV and formed the basis for the present Tevatron.

The money left over, and the use of superconducting technology to build magnets with very high fields, held the promise that a 1-TeV machine could be built in the same tunnel. Whether Wilson or the government owned the money was contested by some, but not by Bob! He put together a strong team and started to develop suitable magnets. A 10-foot-long magnet was constructed and failed miserably. In typical fashion, he immediately started a model magnet programme, building one-foot-long magnets with the goal of learning how to tame this new technology. This programme allowed us to build model magnets embodying new concepts in just a few weeks. At the same time, a large plant had to be built to supply liquid helium to the six-kilometre circumference of the ring, and industry had to be encouraged to supply tons of superconductor instead of a few pounds. It was Wilson's single-minded pursuit of this dream that finally resulted in the Tevatron and the present pre-eminent position of Fermilab.

Bob Wilson was much more than just an accelerator builder. He designed the whole laboratory, using his skill as an artist and sculptor to carve a unique campus from the flat cornfields of Illinois. The central high-rise building was inspired by the cathedral at Beauvais; the farm houses were saved and used to house scientists; the prairie was restored; trees were planted and sculpture was installed; and innovative architecture was used everywhere. This was to be a laboratory that would attract citizens as well as scientists. Wilson Hall is not only the highest point around, but anyone can go to the fifteenth floor and look out at Illinois as well as receiving an explanation of the science that goes on at Fermilab. Wilson's concern for human rights was manifested in his equal-opportunity stance when construction began.

Wilson made his mistakes, of course. Indeed, the laboratory has many examples of failed experiments. But experiments teach, whether they are a success or not. The model magnet with which he is pictured here failed, but the Tevatron is a tremendous success. Wilson Hall is being repaired because temperature stress has induced fractures in some of the concrete elements. But the early cathedral builders who inspired Wilson also experimented and had failures. The spire of Beauvais cathedral collapsed, suffering a fate far worse than the minor troubles at Fermilab. Jean Mignot, one of the master masons for Milan Cathedral, is quoted as saying "*ars sine scienta nihil est*" ("art without science is nothing"). Bob Wilson certainly believed this — and that science without art is nothing.

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