Georges Charpak

(1924–2010)

Physicist who transformed the measurement of high-energy particles.

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Physicist and campaigner, Georges Charpak has left an enduring mark on science, technology and education. His invention of a type of particle detector — the multiwire proportional chamber — revolutionized the collection of data from high-energy physics experiments. The device allowed physicists to detect new particles and so test fundamental theories about the nature of matter. Modern variants of the detector are still used in high-energy particle accelerators.

Charpak, who died on 29 September, was born in eastern Poland to a poor Jewish family. When he was seven, the family moved to Paris, lured by France's healthier economy. After France surrendered to Germany in 1940, Charpak refused to wear the yellow Star of David, required by Nazi authorities to identify Jews, and he became active in the French Resistance. He was imprisoned by the Vichy government of France in 1943 before being transferred to the Dachau concentration camp in 1944. He survived because the German guards did not realize that their political prisoner was actually Jewish.

After the war, Charpak became a French citizen. In 1954, he received his doctorate in nuclear physics from the Collège de France in Paris where he studied in the laboratory of the Nobel laureate Frédéric Joliot-Curie. He devoted his early career to nuclear physics before switching to high-energy particle physics under the guidance of Leon Lederman at CERN, Europe's particle-physics laboratory near Geneva, Switzerland.

In 1968, while still at CERN, but by then leading a small research group of his own, Charpak developed the multiwire proportional chamber.

When high-energy collisions occur between particles in an accelerator, they generate new charged particles that ionize the detector gas, leaving behind a trail of electrons and positive ions. Early detectors, such as the bubble chamber, worked by taking photographs of the tracks left by these charged particles moving through a medium (often liquid hydrogen in the case of the bubble chamber). Yet such devices could generate only a few photographs per second.

Charpak's multiwire chamber was a gas-filled box containing a large number of parallel detector wires, each connected to individual amplifiers. It recorded the electronic pulses resulting from charged particles passing through the gas. These signals could be fed directly into a computer, increasing the detection rate of particles a thousand-fold.

Others had attempted to invent a similar device but without success — largely because it was unclear what was producing the electronic signals in the wires. Working with similar detectors in the Collège de France, Charpak realized that the electronic pulses were produced not by drifting electrons but rather by positive ions, which induced pulses of opposite polarity in the wires. This discovery led him to make large flat detectors containing several wires. Charpak's insight meant the position of a particle could be tracked with unprecedented precision.

BELATED PRIZE

The speed and precision of the multiwire chamber and its descendants, the drift chamber and the time projection chamber, have allowed physicists to operate experiments at much higher particle collision rates and so test new theories about the nature of matter. In recognition of the importance of his work on this and other detectors, Charpak was awarded the Nobel Prize in Physics in 1992.

Years before Charpak received his prize, Nobels were awarded to physicists Samuel Ting and Carlo Rubbia, for their discoveries of the J/ψ particle, and the heavy W and Z particles, respectively. Both scientists made their findings using multiwire chambers. Indeed, many of the new particles discovered in the past few decades have used detectors developed or greatly improved by Charpak and his team.

From the moment Charpak began working on detectors, he was interested in the their medical applications. Although a longtime proponent of nuclear energy, he was horrified by the radiation doses that children were exposed to during routine medical X-rays. He helped co-found several companies that applied his multiwire detectors to medical imaging, to reduce the exposure of patients to radioactive tracers. He also worked closely with surgeons and radiologists to bring these techniques to clinical settings.

Influenced by his experiences in wartime Europe, Charpak's deep concern for social issues led him to apply his knowledge to education. In 1996 he created *La main à la pâte*, an organization that introduced hands-on science education in primary schools in France. He got the idea from his old colleague Lederman, who had introduced a similar physics education programme in Chicago a few years earlier. *La main à la pâte* has now spread from France to other countries.

In 2001, he and nuclear physicist Richard Garwin argued in their book *Megawatts and Megatons: a Turning Point in the Nuclear Age?* that nuclear energy could provide an assured, economically feasible and environmentally sustainable supply of energy without driving weapons proliferation. Three years later, Charpak and Henri Broch co-authored *Debunked! ESP, Telekinesis, and other Pseudoscience*, in which they dismantled claims from parapsychology and astrology.

Georges disliked the new generation of digital detector devices. When he came to visit my laboratory at Saclay, he'd use an old instrument that we kept especially for him. He was excited, however, by a new radon detector he was developing. Indeed, he believed that this detector would have enough industrial success to allow him to "buy a new pair of shoes". Georges will be remembered as a humanist, an enthusiast, an optimist — and someone always open to new ideas. ■

Ioannis Giomataris *is research director at CEA-Saclay 91191 Gif-sur-Yvette Cedex. France.*
e-mail: ioanis.giomataris@cern.ch