Richard E. Taylor

November 2, 1929 - February 22, 2018

Richard E. Taylor, a Canadian-born experimental physicist who shared the 1990 Nobel Prize for the discovery of quarks, one of the fundamental particles in the universe, died on Feb. 22 in Stanford, Calif. He was 88.

Stanford University, where he worked, announced his death but did not cite a cause.

The discovery of quarks, in the late 1960s, was a ground-shaking event in physics. It paved the way for the development of the Standard Model, the classification system for all known elementary particles and forces.

Before their discovery, “we had this vast collection of particles and did not know how they were put together,” Martin Breidenbach, a professor of high-energy research at Stanford, told The Stanford News. Among these were composite particles called hadrons.

The Standard Model that resulted, he said, “was a way of basing all the hadronic particles we knew about, including protons and neutrons, on more fundamental particles called quarks, and once that was clear, this whole big mess fell away.”

The discovery of quarks was unexpected, though the experiments by Dr. Taylor and others that revealed them were built on previous research, particularly that of Dr. Robert Hofstadter, another Stanford physicist and Nobel laureate.

Dr. Hofstadter’s research, like that of physicists before and since, was designed to explore the inner workings and architecture of the subatomic world, which had first been revealed by Ernest Rutherford in the early 20th century.

Dr. Rutherford had discovered that the nucleus of atoms contained positively charged particles that he called protons. He and physicists who came after him assumed that they were elementary, or fundamental, particles.

Dr. Hofstadter wanted to measure their size, to understand the internal structure of nuclei. He did so by aiming electrons at the nucleus of a hydrogen atom and measuring the angles at which they were deflected. The experiment was known as elastic scattering, because the kinetic energy of the electrons was conserved in the interactions. Dr. Hofstadter was awarded the 1961 Nobel Prize in Physics for his research.

But to continue the investigation into the fundamental nature of matter and particles, more powerful equipment was needed, so Stanford, with the federal government’s backing, built the Stanford Linear Accelerator Center, known as SLAC. When it was finished, in 1966, it had two miles of equipment and was the world’s most powerful electron accelerator. Among other things, Dr. Taylor assembled SLAC’s two-story tall spectrometer, a device that identifies particles and atoms based on their mass, momentum and energy, and tracks their trajectories in the accelerator.

The first experiments performed at SLAC were in elastic scattering, but they provided no new insights. Then the accelerator was used to perform what is called deep inelastic scattering, in which electrons bombard protons and neutrons. Here some of the electrons’ energy is transferred to the bigger particles, sometimes shattering them, and the electrons are deflected.

The same type of experiment had been done with less powerful accelerators, and nothing terribly interesting had happened. That was because few particles had lost their energy and been deflected.

But inelastic experiments performed at SLAC, many of which were led by Dr. Taylor, produced a lot of scattering of particles at very big angles, to a far greater degree than had been predicted.

At first, the scientists thought that their results were incorrect, or that they had misinterpreted them, but the data were eventually confirmed. The number of deflections by the electrons, and the wide angles of their deflection, showed that protons were not solid — that they contained internal structures.

Persis Drell, a former director of SLAC and now the provost of Stanford, told The Stanford News that the experiments by Dr. Taylor and his colleagues had shown that the proton was like “jam, with seeds” (the quarks), rather than like “a smooth ‘jelly’ ” of electrical charge.

Before these experiments, it was generally assumed that protons and neutrons were elementary particles — that is, that they were nondivisible. “I don’t think anyone was seriously questioning the elementary character of the proton at that time,” Dr. Taylor said in his Nobel lecture.

Dr. Taylor shared the 1990 Nobel with two physicists at the Massachusetts Institute of Technology, Jerome I. Friedman and Henry W. Kendall, who had also worked on the experiments at SLAC alongside Dr. Taylor.

Dr. Taylor believed that many others deserved to share in the prize as well, among them Wolfgang K. H. Panofsky, the director of SLAC from its founding until 1984. He had been the driving force in getting the accelerator built and oversaw it at a time when four different experiments performed there would lead to Nobel Prizes.

“There were 20 of us named on that experiment,” Dr. Taylor said in a 2008 interview with the Nobel Institute, referring to their work on deep inelastic scattering. “There were, like, 40 of us who built that apparatus, backed up by another 40 engineers and technicians, using an accelerator that is built by a thousand people.”

A science prize given to even more recipients, he said, would “acknowledge that it is not the work of an individual person, but a huge group of people."

Richard Edward Taylor was born on Nov. 2, 1929, in Medicine Hat, Alberta, the son of a Canadian father (whose own parents had immigrated from Northern Ireland and Scotland) and an American mother (a daughter of Norwegian immigrants).

When he was young, Richard wanted to be a surgeon, but while in high school he lost the forefinger and parts of the middle finger and thumb on his left hand after accidentally blowing up a chemistry lab in his basement at home. He recalled that a surgeon said to him at the time, " 'People aren't going to come to a surgeon without fingers.' So I had to give that up." He switched to science.

Though he did not get his high school degree — he failed Latin — he was admitted to a four-year honors program in physics at the University of Alberta. But at the end of the third year he became ill, was hospitalized and was dropped from the program. He received a non-honors Bachelor of Science degree and then a master's.

During his time at the university Dr. Taylor married Rita Bonneau. They had one son, Ted. Both survive him. Information about other survivors was not available.

Dr. Taylor applied to the University of California at Berkeley for his Ph.D. but was rejected. Stanford, which had an up-and-coming physics department, accepted him, despite his middling grades at Alberta.

Dr. Taylor worked in the High-Energy Physics Lab at Stanford until 1958, when physicists at the École Normale Supérieure invited him to Paris. The group was building an accelerator in Orsay and sought his expertise. Dr. Taylor stayed there three years, gaining experience that helped him later when building SLAC.

After returning from France, he worked for a year at Berkeley before rejoining Stanford, where the construction of SLAC had just begun. He remained at Stanford the rest of his life and lived on its campus.

Dr. Taylor continued to work at SLAC throughout the 1970s. One of his notable efforts came in 1978, when he confirmed a revolutionary theory — put forth by Steven Weinberg, Sheldon Less Glashow and Abdus Salam — positing that two of the four known forces in the universe, weak and electromagnetic, are aspects of the same force, called the electroweak force, when particles have very high energy levels.

The theory was important because, if confirmed, it would provide an essential building block to a long-sought unified theory to explain all the workings of the universe.

Dr. Taylor was able to confirm the theory in an experiment he designed that afforded a higher degree of precision than had previously been possible. It showed that at some point in the history of the universe there were three, not four, forces. Dr. Weinberg, Dr. Glashow and Dr. Salam were awarded the Nobel Prize the following year.

Dr. Taylor saw himself, matter-of-factly, as an experimentalist in physics, not a theoretician.

"My job was to measure things and to make sure that the measurements were right," he said in the 2008 Nobel interview. “It is the job of the theoretical community to understand why things are the way that I see them when I do the experiments.

“So I was not running around saying that I have discovered quarks,” he continued, adding: “I am telling you how electrons scatter from protons. You are telling me what’s inside that scatters the electrons. I didn’t have a real stake.”

Obituary Credit: https://www.nytimes.com/2018/03/01/obituaries/richard-e-taylor-nobel-winner-who-plumbed-matter-dies-at-88.html

A note from Martin Oaks Cemetery & Crematory:

This passing is certainly some attention. Physicist Richard E. Taylor was an important contributor. RIP.