

Scientists find evidence of last quark

The Associated Press

BATAVIA, Ill. — A team of 440 scientists has successfully concluded an intensive, 17-year search for one of the most elusive and mysterious objects in the universe — the top quark.

On Tuesday, researchers at the Fermi National Accelerator Laboratory announced they had found the first evidence of its existence.

If confirmed, it would support our basic understanding of the nature of time, matter and the universe.

"If it had not been discovered... I think the whole picture of the universe would have collapsed," said physicist Michael Riordan at the Stanford Linear Accelerator Center in California.

The finding also would mark the end of a worldwide search for the six quarks that make up protons and neutrons inside atoms.

"We have not yet observed enough examples of top quark production to establish the particle's existence beyond question," said Melvyn Shochet, a University of Chicago physicist involved in the research.

"Nevertheless, this new evi-

"If it had not been discovered . . . I think the whole picture of the universe would have collapsed."

— Michael Riordan, physicist at the Stanford Linear Accelerator Center in California

dence points strongly to the existence of the sixth and final quark that we have been seeking for so long."

The Fermilab team continues to search for more evidence to verify the top quark's existence, said Judy Jackson, a spokeswoman for Fermilab.

Without the top quark, the Standard Model would collapse, forcing scientists to rethink three decades of research.

Five quarks had already been discovered — the last in 1977 at Fermilab. Since they're believed to come in pairs, scientists believed a sixth, or top quark, must exist.

Its elusiveness "has been a glaring hole," said Alan Weinstein, a physicist at California Institute of Technology. He called Fermilab's efforts "a beautiful and important discovery."

Researchers at Fermilab discovered the last quark has been hard to find because of its tremendous mass — 35 times heavier than the fifth quark.

"It's the most massive fundamental particle that we know of," Weinstein said.

The more massive a subatomic particle, the more energy is required to produce it, and the more difficult it is to find.

Despite its mass, the top quark is smaller than a trillionth of the thickness of a human hair, and it exists for only a trillionth of a trillionth of a second, Riordan said in a telephone interview.

Scientists didn't actually see it, but found evidence that it exists from patterns created by experiments in Fermilab's underground Tevatron supercollider.

In the four-mile circular collid-

er, they used an electronic field to accelerate larger particles at nearly the speed of light, then made them collide.

"Because you have so much energy," the collision creates a quark heavier than the original particles, Jackson said.

"It's as if two tennis balls collided and a bowling ball flew out," the spokeswoman said.

The first signs of the top quark came last June, but it has taken months to analyze and test the results, Jackson said.

Though the discovery is reassuring to physicists, it raises another, more mysterious question, Riordan said.

"Why is this thing so colossally heavy? It's like you're building a home of bricks and every sixth one is made out of lead," he said.

"It must have some intimate relationship with whatever the origin of mass is, but we have no idea why the top quark is so massive," Weinstein said.

The six quarks are named "up" and "down," "charm" and "strange" and "top" and "bottom." A physicist took the word "quark" from a line in James Joyce's "Finnegans Wake": "Three quarks for Muster Mark."

Mourners fall silent as Nixon's hearse arrives

The Associated Press

YORBA LINDA, Calif. — Former President Nixon flew home Tuesday for the last time.

Nixon's flag-draped casket was flown from New York, where he died Friday, to El Toro Marine Corps Air Station, and was taken 20 miles by motorcade to Yorba Linda, his birthplace and site of his burial Wednesday.

His coffin was carried by the same blue and white plane that flew the 37th president to California after he resigned as president nearly two decades ago.

Hundreds of mourners fell silent as the hearse pulled up to the Richard Nixon Library & Birthplace in a thunderstorm. The body was to lie in state in the library lobby until the funeral, which will be attended by every president to serve since Nixon.

First in line for the viewing was Bill Anderson, 47, of Barstow, who left home at 6 a.m. "to show honor to the president" and to see his 21-year-

old son, Albert, a member of the military honor guard.

"For any man to give his whole life for this country, I would have to have a strong feeling for him," Anderson said.

"I'm here to pay my respects to my commander in chief," said Bernice L. Collins, an 81-year-old former Nixon campaign worker who sat in a wheelchair nearby.

Nixon's daughters, Tricia Cox and Julie Eisenhower, their husbands and four children accompanied the casket on the flight from Stewart Air National Guard Base in Newburgh, N.Y.

The Boeing 707 touched down about 12:30 p.m.

The final journey began at the Vander Plaats Funeral Home in Wyckoff, N.J., where Nixon's body was brought after his death in a New York hospital Friday night. The former president was laid out in a blue suit, said William Brock, one of the funeral home owners.

When the casket arrived at Stewart, howitzers

boomed a 21-gun salute and a band played "Hail to the Chief" during a 20-minute ceremony. A Marine honor guard stood at attention, holding a gun as a tear streamed down his cheek.

In California, the 3rd Marine Aircraft Wing Band played "Ruffles and Flourishes," "Hail to the Chief" and "America the Beautiful" as four howitzer cannon gave another 21-gun salute.

Nixon did not want a Washington funeral, and his family declined to have his body lie in state in the Capitol Rotunda. On Thursday, members of Congress marked his death in the Rotunda anyway, placing a large wreath at its center, where the coffin would have been.

Nixon will be buried next to his wife, Pat, just a few steps from the tiny clapboard farmhouse where he was born 81 years ago. Mrs. Nixon died of cancer in June.

President Clinton will deliver a eulogy, as will Sen. Robert Dole, former Secretary of State Henry Kissinger and Gov. Pete Wilson. The Rev. Billy Graham, a longtime Nixon friend, will preside.

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