

SPECIAL
EDITION

FermiNews

The Newsletter of the Fermi National Accelerator Laboratory

FERMILAB SCIENTISTS PRESENT NEW EVIDENCE IN THE SEARCH FOR THE TOP QUARK

This morning, April 26, Fermilab experimenters announced new results in the search for the top quark. In two colloquia in Ramsey Auditorium, spokespersons for CDF and DZero discussed their experiments.

The Collider Detector at Fermilab collaboration presented the first direct experimental evidence for the top quark, a subatomic particle that is the last undiscovered quark of the six predicted by current scientific theory. Scientists worldwide have sought experimental evidence for the top quark since the discovery of the bottom quark at Fermilab in 1977.

A research paper, submitted Friday, April 22, to *The Physical Review* by the 440-member CDF collaboration, presents evidence for the production of top quarks in world-record high-energy collisions between protons and antiprotons, their antimatter counterparts, at Fermilab's Tevatron particle accelerator. The CDF collaboration presented its results at today's scientific colloquium held at Fermilab.

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CDF researchers stopped short of claiming discovery of the top quark, however. "We have not yet observed enough examples of top quark production to establish the particle's existence beyond question," said CDF spokesperson Melvyn Shochet. "Nevertheless, this new evidence points strongly to the existence of the sixth and final quark that we have been seeking for so long." He added that the collaboration expects data from the collider run now underway at Fermilab to yield enough additional top quark events in the next few months to confirm the particle's existence and to improve the precision of measurements of its mass. The Tevatron is the world's highest energy accelerator, the only one capable of producing the top quark.

"I share the excitement of the scientists at Fermilab and around the world who have contributed to this success," said U.S. Secretary of Energy Hazel R. O'Leary. "These results give new im-

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"The search for the top quark has been a re-search effort of heroic proportions. It is gratifying that after more than a decade of intensive searching, we are beginning to observe direct evidence of the top quark.

"As the power of the Tevatron and the collider detectors is improved over the next four years, including the completion of Fermilab's Main Injector, the experimenters will find still more evidence for its existence.

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— Director John Peoples

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Scientists are eager to find and study the top quark, because its discovery would strongly support the Standard Model, the prevailing theory of the particles and forces that determine the fundamental nature of matter and energy. Despite intensive searches at accelerator laboratories in Europe, Japan, and the United States, the top quark has eluded discovery because of its apparent large mass in comparison to other subatomic particles. The more massive a subatomic particle, the more energy is required to produce it in collisions, and the more difficult it is to find.

The Laboratory's DZero collaboration also presented analyses of their top search experiments, providing information beyond recently published results. DZero's preliminary analyses currently show no significant signal for

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the top quark. "More data are likely needed to reach a definitive conclusion," said DZero spokesperson Hugh Montgomery.

CDF's particle detector, the heart of the collaboration's experiment, was constructed with funds provided by the U.S. Department of Energy, the Japanese Ministry of Education, Science and Culture (MONBUSHO), and the Italian Institute for Nuclear Physics (INFN), and the National Science Foundation. Besides U.S. scientists, CDF includes physicists from Italy and Japan, as well as Canadian and Taiwanese experimenters. The DZero collaboration includes many U.S. institutions and groups from Brazil, Colombia, France, India, Korea, Mexico, and Russia. Funds for DZero's detector came from DOE, NSF, Russia, and France.

"It is gratifying that after more than a decade of intensive searching," said Fermilab Director John Peoples, "we are beginning to observe direct evidence of the top quark. As our research tools improve, the experimenters will find still more evidence for its existence. The top quark, a subatomic particle that appears to be as heavy as an entire gold atom, may well unlock some of nature's best-kept secrets."