A huge breakthrough that, if confirmed, may forever change particle physics

If you felt the Earth shake a bit Wednesday, we can probably safely attribute that to the world of physics reacting to a preprint of new paper uploaded to the arXiv server (here's the paper).

The physicists do not claim a discovery, but rather a probable discovery. And if it's verified, it would be "the biggest result in particle physics in about 30 years," Rice University physicist Paul Padley told me.

"If this result survives and is confirmed, then it is astounding," he said. "If confirmed this result would shake our understanding of the basic constituents of the universe. We particle physicists would say the biggest result in physics and our understanding of nature in over 30 years, although the measurement of the accelerating expansion of the universe might be of comparable importance."

Those are pretty strong words. So what exactly are we talking about?

For several decades physicists have developed and refined a Standard Model of particle physics, which essentially describes the nature of particles and forces inside the atom. It has been incredibly successful at making predictions that have been subsequently verified by observations of collisions in atom smashers.

But there's a general feeling in the physics community that the standard model isn't the end-all and be-all, because there are some things it cannot explain, such as why the top quark is so much more massive than other quarks.

"The standard model seems to be a good approximation for something else," said David Toback, a physicist at Texas A&M University.

Toback is among several hundred physicists who work on the large CDF experiment at Fermi National Accelerator Lab outside of Chicago. This is essentially a massive detector in which protons and anti-protons collide, and scientists try to study the fleeting detritus of the collisions. In this chaos they hope to observe exotic particles that existed when the universe was very young and very hot.

One thing the standard model does not predict is the existence of a particle with the energy of about 140 billion electron volts. But after years of collecting data, it seems that's what Toback and other physicists have found.
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Comments

Good Science is skeptical, always, and this story smacks of good science!

We've had enough 'cold fusion' excitement (I was _very_ excited for about a week...) so it is good this is being handled...carefully.

Now, what the eventual effects of such a new understanding could be is up to the science fiction writers to let us know! :-(

Posted by: Brian at April 7, 2011 07:59 AM
I'm just thankful that they didn't find the Higgs-Boson; the SM is kind of boring if you just find the magical missing link and call it done. It is suggested that they found two new particles or a new force of nature - either would be, as you quoted, "the biggest result in particle physics in about 30 years."

Posted by: M1000 at April 7, 2011 08:22 AM

Data infers there is something there. Now to go find it. This does smack of good science.

Posted by: NoWhining at April 7, 2011 08:25 AM

This is indeed huge news, thanks for such a great write-up Eric. I love that the "discovery" was made at Fermilab before that accelerator is fully superseded by the LHC. I also agree with M1000 that finding something unknown is more exciting than just finding the Higgs.

Good stuff indeed.

Posted by: Rich Abercrombie at April 7, 2011 08:29 AM
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