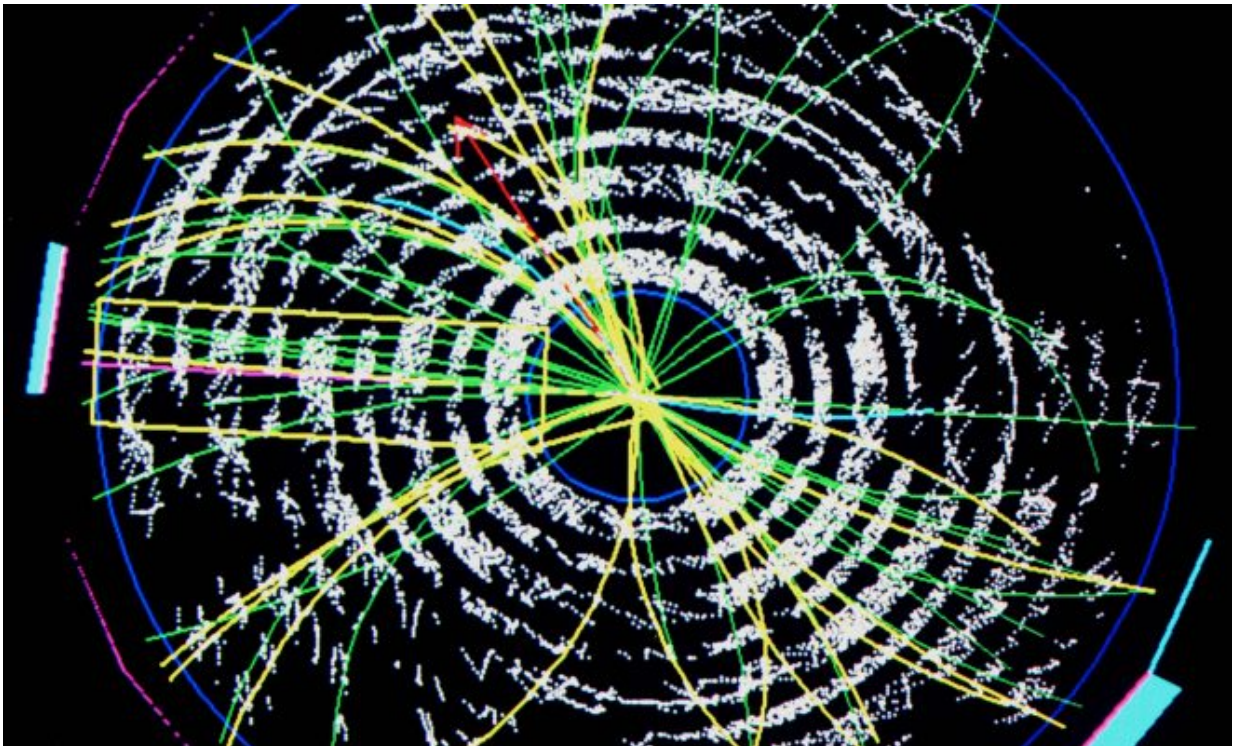


# Heavy, short-lived elementary particle could help refine understanding of the universe

February 10 2017, by Adam Lowenstein

---



This image, courtesy of Fermilab, shows a collider detector event that captured a possible top quark pair candidate. Tracks shown are from the decays of two top quarks produced in a collision. Deeper knowledge about the characteristics of the top quark could boost our understanding of the fate of our universe. Credit: Florida Institute of Technology

The top quark is a unique little thing.

It is the heaviest known fundamental particle, for starters. Although 100 million times smaller than an atom of gold, it has roughly the same mass. It also has an extraordinarily short lifetime. In fact, the life of a top [quark](#) is so fleeting, scientists can only detect its presence by documenting a signature trail of [particles](#) left behind as it decays.

But more so than its quirks, the top quark may hold the key to a deeper understanding of the fate of our [universe](#).

If researchers at Florida Institute of Technology, employing pioneering new methods, are able to determine the top quark's mass at a level of precision as yet unachieved, they will move science closer to understanding whether the universe is stable, as we have long believed to be the case, or unstable.

They are reexamining the mass of the top quark using data collected by the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider (LHC), the world's largest and most powerful particle accelerator based near Geneva, Switzerland.

The top quark doesn't get as much love as another particle, the Higgs boson, which with its famous quantum field is responsible for giving all other particles their mass. But the top quark plays an important role in confirming the validity of the underlying theories of particle physics and the state of our universe.

"Not many people talk about the universe as a quantum mechanical system and particle masses but it turns out the stability of our universe as a quantum system depends on the masses of the top quark and the Higgs boson," said Marc Baarmand, professor of physics and space sciences at Florida Tech who studies the top quark and brought the LHC research to Florida Tech in 2000. "Because the measurements are still not very precise, we are unsure if we are living in a stable or metastable universe.

"The current top quark mass measurements are limited by the systematic uncertainties coming from both data and theory," Baarmand continued.

"The new method aims at an alternative measurement with reduced systematic uncertainties."

A more precise measurement of the top quark mass, Baarmand added, "could also help open doors to new physics, and perhaps it could help point us to other new particles in the future."

In addition to their studies of the top [quark mass](#), Florida Tech researchers led by Francisco Yumiceva, associate professor of physics and space sciences, built, calibrated and are operating the hadron calorimeter detector, which measures the energy of particles. Another team, led by Florida Tech's Marcus Hohlmann, professor of physics and space sciences, is developing Gas Electron Multiplier chambers, which precisely measure the trajectories of muons. These researchers and their students study the daughter particles produced by top quarks and Higgs bosons as they decay to better understand how these important particles fit into the large physical framework of the subatomic universe.

Provided by Florida Institute of Technology

Citation: Heavy, short-lived elementary particle could help refine understanding of the universe (2017, February 10) retrieved 15 May 2024 from <https://phys.org/news/2017-02-heavy-short-lived-elementary-particle-refine.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.