# Possible hints of much-sought mystery particle reported

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Courtesy of Caltech
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**New results from the world's largest particle smasher might hint at the existence of an elusive particle physicists have been seeking for years, the Higgs boson, some researchers say.**

**This entity is thought to be responsible for endowing every other fundamental particle of matter with mass, or weight. This is according to the conventional thinking in physics, embodied in a set of ideas called the Standard Model. The Higgs boson is in fact the last particle that is predicted by the Standard Model but not yet detected.**

The Compact Muon Solenoid detector, one of two instruments at the Large Hadron Collider whose unusual readings are leading some to speculate that the elusive Higgs particle may have been found. (Credit: Boreham, S; Brice, M; Ginter, P; Marcelloni, C; Collaborat, CMS)

**The particle smasher reported to have gathered the intriguing data, called the Large Hadron Collider, blasts beams of subatomic particles together at near-light speed to break them into their parts for study. Many of the resulting particles disintegrate almost instantly, making their analysis hard, but physicists hope to tease out signs that some of them are Higgs bosons.**

**Although some of the signals generated from the collider's detectors are statistical noise, two recent experiments have found an "excess" of signals consistent with a characteristic expected for the Higgs, researchers say. That characteristic is its theorized range of mass, believed to be**

between 130 and 150 gigaelectron volts, the units used to weigh subatomic particles.

The data aren't yet statistically significant enough to be called a definite signal, let alone a discovery of a particle, cautioned Harvey Newman, a physicist at the California Institute of Technology involved with the project. However, the data come from two different types of detectors connected to the collider, which lies underground near Geneva, Switzerland.

The unusual readings could be due to some unknown source or could be the first signs of the Higgs, Newman said. "One could speculate that it's an unusual statistical fluctuation," he added, "but I don't think so." The developments were announced a meeting of the European Physical Society in Grenoble, France, held from July 21 to 27.

The Higgs boson concept dates to 1964, when a physicist, Peter Higgs, proposed the existence of a "field" that permeates the universe. Just as a magnetic field interacts with iron filings, this "Higgs field" fills the space between every fundamental particle and interacts with those particles. These interactions slow a particle as it moves through the field. A low-mass particle such as the electron, for example, is that way because it doesn't interact with the Higgs field much. Thus it can zip through the field with ease like a sleek anchovy swimming through the ocean. But particles like the so-called top quark, which is part of the nucleus of atoms, interact with the Higgs field more strongly, so to them, the field is more like an ocean of molasses. The top quark is thus heavy and sluggish, weighing in at more than 300,000 times the mass of an electron.

In physics, every field has an associated particle; the electromagnetic field, seen by us as light, is associated with the photon, for instance. For the Higgs field, the associated particle is the Higgs boson. By interacting with itself, it's responsible for its own mass.

The Large Hadron Collider is still in the process of being increased in power, so physicists hope to raise the number of collisions to improve the chances of producing Higgs bosons. Some speculate that by the end of next year, they may determine once and for all whether the Higgs exists.

If it turns out not to, physicists will have to do some serious rethinking about the Standard Model. "But even if the Higgs exists, the Standard Model still has fundamental problems," Newman said. For example, the theory is not self-consistent. "The most natural way to solve these problems," he said, is with a theory called "supersymmetry," for which some researchers hope the collider will also turn up supporting evidence.

This theory predicts each known particle has a massive, unseen companion particle called its "superpartner." The scheme creates a tidy correspondence between two families of particles, those that make up matter and those that transmit forces. As a bonus, supersymmetry predicts the existence of particles that could be the dark matter—a stuff astronomers say they have detected through its gravitational effects, but that otherwise seems invisible.