The Higgs Boson and a 'New Physics' --"Could Make the Speed of Light Possible"

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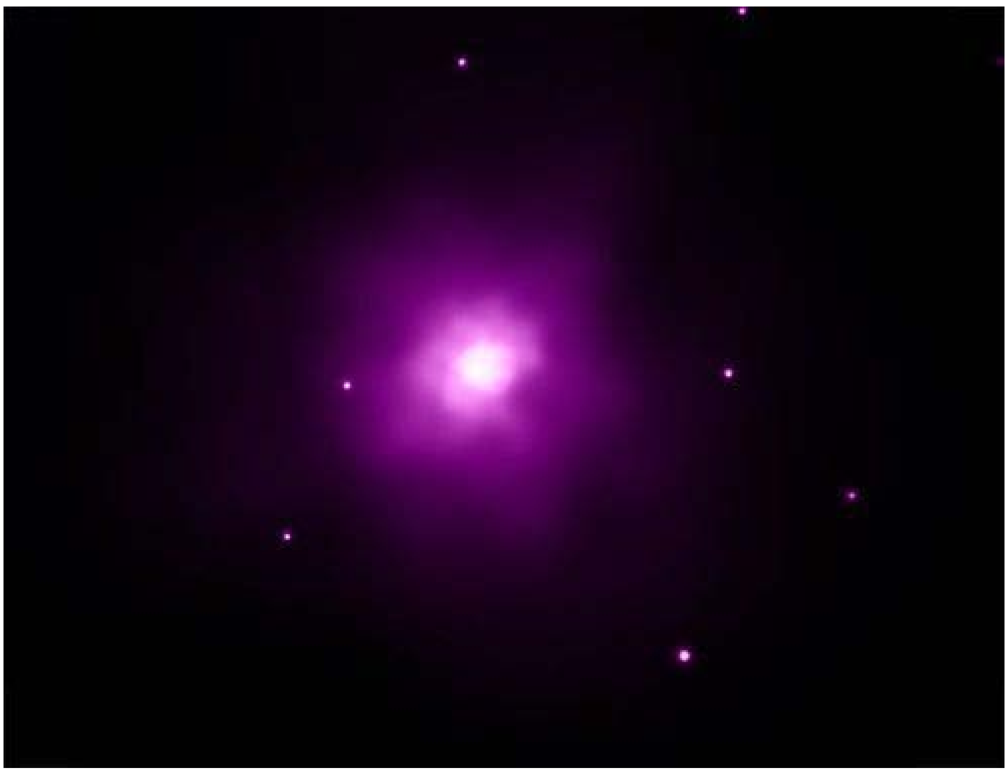

Scientists hailed CERN's confirmation of the Higgs Boson in July of 2012, speculating that it could one day make light speed travel possible by "un-massing" objects or allow huge items to be launched into space by "switching off" the Higgs. CERN scientist Albert de Roeck likened it to the discovery of electricity, when he said humanity could never have imagined its future applications.

CERN physicists hope that the "new physics" will provide a more straightforward explanation for the characteristics of the Higgs boson than that derived from the current Standard Model. This new physics is sorely needed to find solutions to a series of yet unresolved problems, as presently only the visible universe is explained, which constitutes just four percent of total matter.

"The Standard Model has no explanation for the so-called dark matter, so it does not describe the entire universe – there is a lot that remains to be understood," says Dr. Volker Büscher ofJohannes Gutenberg University Mainz (JGU).

The discovery of the long-sought Higgs boson, an elusive particle thought to help explain why matter has mass, was hailed as a huge moment for science by physicists. In July of 2012, CERN, the European Organization for Nuclear Research in Geneva, announced the discovery of a new particle that could be the long sought-after Higgs boson. The particle has a mass of about 126 gigaelectron volts (GeV), roughly that of 126 protons.

The new evidence came from an enormously large volume of data that has been more than doubled since December 2011. According to CERN, the LHC collected more data in the months between April and June 2012 than in the whole of 2011. In addition, the efficiency has been improved to such an extent that it is now much easier to filter out Higgs-like events from the several hundred million particle collisions that occur every second.

The existence of the Higgs boson was predicted in 1964 and it is named after the British physicist Peter Higgs. It is the last piece of the puzzle that has been missing from the Standard Model of physics and its function is to give other elementary particles their mass. According to the theory, the so-called Higgs field extends throughout the entire universe. The mass of individual elementary particles is determined by the extent to which they interact with the Higgs bosons.

"The discovery of the Higgs boson represents a milestone in the exploration of the fundamental interactions of elementary particles," said Professor Dr. Matthias Neubert, Professor for

Theoretical Elementary Particle Physics and spokesman for the Cluster of Excellence PRISMA at JGU.
On the one hand, the Higgs particle is the last component missing from the Standard Model of particle physics. On the other hand, physicists are struggling to understand the detected mass of the Higgs boson. Using theory as it currently stands, the mass of the Higgs boson can only be explained as the result of a random fine-tuning of the physical constants of the universe at a level of accuracy of one in one quadrillion.
The Higgs helps explains how the world could be the way that it is in the first millionth of a second in the Big Bang.

Physicist Ray Volkas said "almost everybody" was hoping that, rather than fitting the so-called Standard Model of physics -- a theory explaining how particles fit together in the Universe -- the Higgs boson would prove to be "something a bit different".

"If that was the case that would point to all sorts of new physics, physics that might have something to do with dark matter," he said, referring to the hypothetical invisible matter thought to make up much of the universe.

It could be that the Higgs particle acts as a bridge between ordinary matter, which makes up atoms, and dark matter, which we know is a very important component of the universe.

"That would have really fantastic implications for understanding all of the matter in the universe, not just ordinary atoms," he added. De Roeck said scrutinising the new particle and determining whether it supported something other than the Standard Model would be the next step for CERN scientists.

Definitive proof that it fit the Standard Model could take until 2015 when the LHC had more power and could harvest more data.

Instead, De Roeck was hoping it would be a "gateway or a portal to new physics, to new theories which are actually running nature" such as supersymmetry, which hypothesises that there are five different Higgs particles governing mass.

For the image at the top of the page, two teams of astronomers used data from NASA's Chandra X-ray Observatory and other telescopes to map the distribution of dark matter in a galaxy cluster known as Abell 383, which is located about 2.3 billion light years from Earth. Not only were the researchers able to find where the dark matter lies in the two dimensions across the sky, they were also able to determine how the dark matter is distributed along the line of sight. Several lines of evidence indicate that there is about six times as much dark matter as "normal", or baryonic, matter in the Universe. Understanding the nature of this mysterious matter is one of the outstanding problems in astrophysics.
Galaxy clusters are the largest gravitationally-bound structures in the universe, and play an important role in research on dark matter and cosmology, the study of the structure and evolution of the universe. The use of clusters as dark matter and cosmological probes hinges on scientists' ability to use objects such as Abell 383 to accurately determine the three-dimensional structures and masses of clusters.