Large Hadron Collider (LHC): Notes for UPSC Science and Technology

The Large Hadron Collider or LHC is an important topic in science and technology for the UPSC exam. It figures in the news frequently and is hence relevant to the IAS exam. One of the chief objectives of this big machine was to find out more about the existence of the Higgs Boson particle.

The particle boson is named after eminent Indian scientist Satyendra Nath Bose. So, this assumes even more importance for the IAS exam.

What is the Large Hadron Collider?

The Large Hadron Collider (LHC) was constructed to figure out what the Higgs field is, how it works, etc. It is the world's largest and most powerful particle accelerator. It was constructed by the European Organization for Nuclear Research (**CERN**) between 1998 and 2008 in partnership with over 10,000 scientists and engineers from over 100 countries, universities, and laboratories. It was constructed to do much more than discovering the Higgs Boson. The objective of the LHC was to help physicists test predictions of various theories of particle physics. This included measuring the properties of the Higgs Boson and also searching for the big family of new particles as predicted by supersymmetric theories.

The collider has four crossing points, around which are positioned seven detectors, each designed for certain kinds of research. The LHC primarily collides proton beams, but it can also use beams of heavy ions: lead–lead collisions and proton–lead collisions are typically done for one month per year.

What is the purpose behind the LHC?

Many physicists hope that the Large Hadron Collider will help answer some of the fundamental open questions in physics, which concern the basic laws governing the interactions and forces among the elementary objects, the deep structure of space and time, and in particular the interrelation between quantum mechanics and general relativity.

Data are also needed from high-energy particle experiments to suggest which versions of current scientific models are more likely to be correct – in particular to choose between the Standard Model and Higgsless model and to validate their predictions and allow further theoretical development.

The ultimate aim of the LHC's detectors is to allow physicists to test the predictions of different theories of particle physics, including measuring the properties of the Higgs boson and

searching for the large family of new particles predicted by supersymmetric theories, as well as other unsolved questions of physics.

Where is it located?

This giant and complex machine is located underneath the earth's surface at a depth of 175 metres below the border between France and Switzerland near Geneva. It lies in a tunnel that is 27 km in circumference.

Its first research took place in March 2010. It discovered the elusive Higgs boson in July 2012.

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