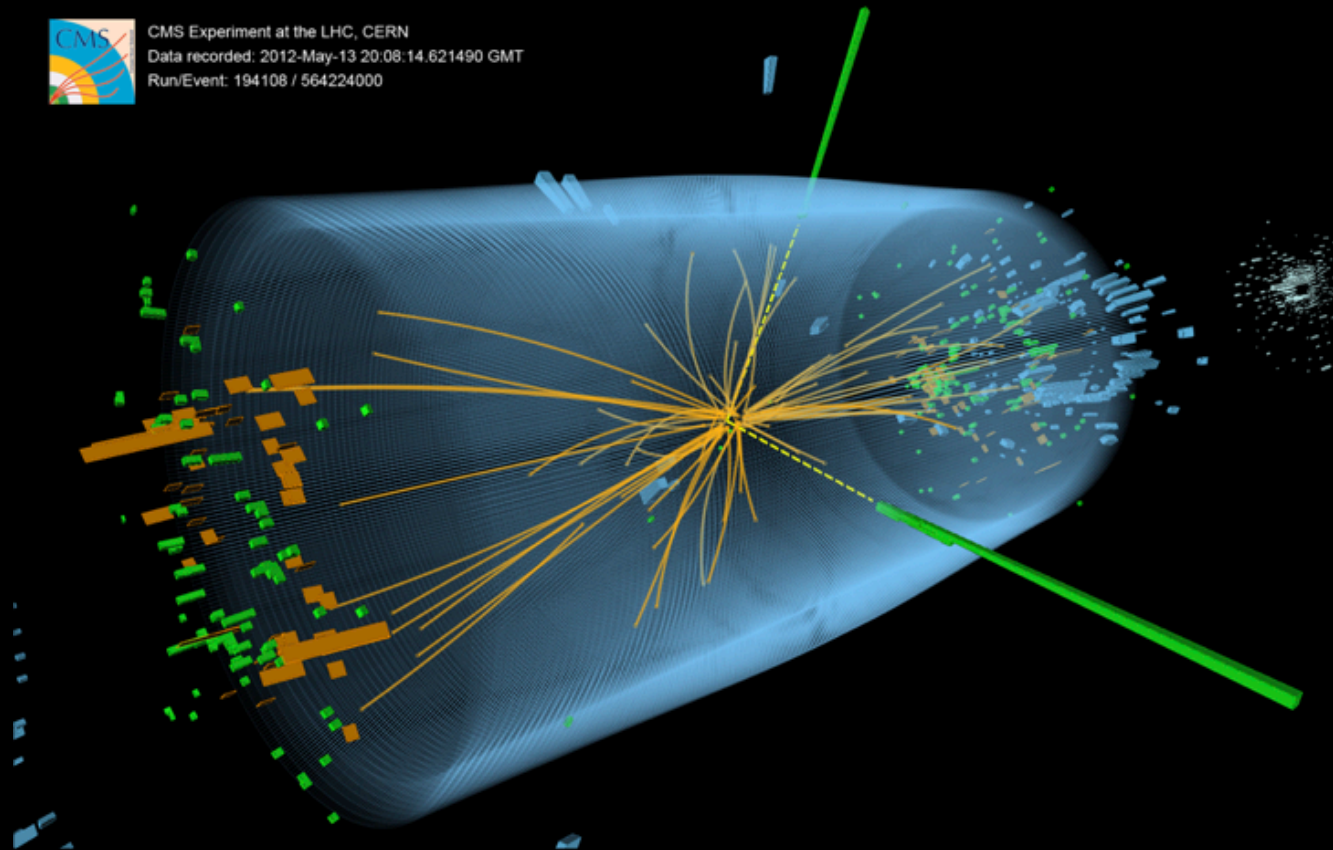# Higgs Physics in the Standard Model and Beyond

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★ The Higgs boson is a key piece in the Standard Model (SM) building.

★ Its discovery (July, 2012) is the greatest achievement in particle physics in decades

CMS Experiment at the LHC, CERN
Data recorded: 2012-May-13 20:08:14.621490 GMT
Run/Event: 194108 / 564224000

Higgs Physics in the Standard Model and Beyond

In this Lab:

We will first review the formulation of the Higgs mechanism in the SM, recalling the way the Higgs field provides a mass to all (massive) particles

Then, you will explore a few things

Higgs Physics in the Standard Model and Beyond

The strange case of neutrino masses

The strange case of neutrino masses

★   Why are they that small?

The strange case of neutrino masses

★   Why are they that small?

★   Is it a hint of new physics?

In the Lab:

You will determine the characteristics (mass, spin, quantum numbers) of an (hypothetical) new particle, X, responsible for the tiny neutrino masses
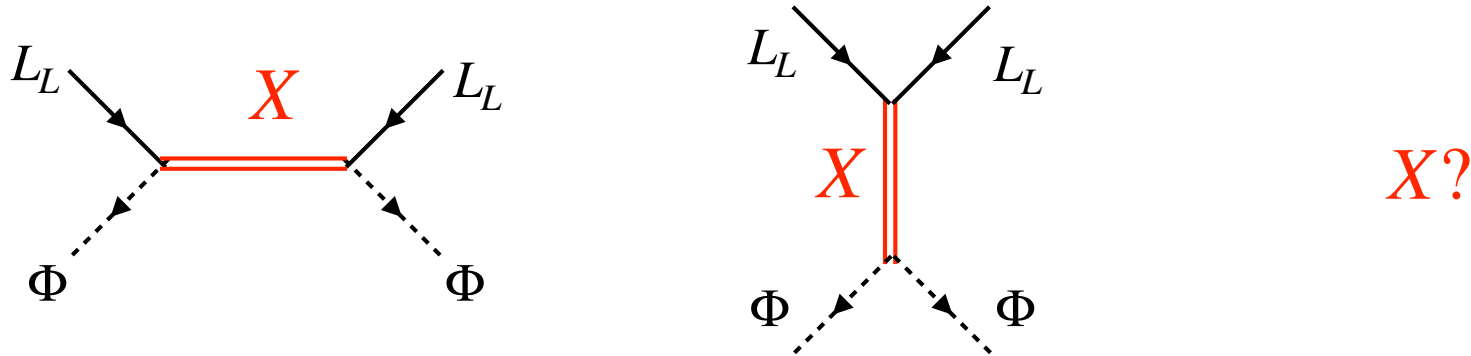
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The Higgs mechanism has proven to be successful (so far)

But… is it fully satisfactory?

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What's ugly about the Higgs Mechanism?

Higgs Physics in the Standard Model and Beyond

The Higgs mechanism has proven to be successful (so far)

But… is it fully satisfactory?

What's ugly about the Higgs Mechanism?

We will debate about this and discuss how it suggests the existence of BSM physics of some kind

Higgs Physics in the Standard Model and Beyond

In particular, we will consider the

Naturalness (or "Hierarchy") problem

associated to the Higgs.

One possible solution to this problem is **Supersymmetry**:
a well-motivated candidate for BSM physics

Higgs Physics in the Standard Model and Beyond

In the Lab:

★ We will review the Higgs sector in SUSY scenarios

★ You will estimate the prediction for the Higgs mass in supersymmetric models

   (tree-level + radiative corrections)

★ And draw conclusions from the result