

The Higgs Boson

Both Matter and Antimatter have Mass

What gives masses to fundamental particles such as quarks and electrons and why are they so different?

Fundamental particles do not have any size. Here the different sizes represent the different masses.
Leptons are in orange
Quarks are in red

e^- Electron

μ^- Muon

τ^- Tau

u Up

c Charm

t Top

d Down

s Strange

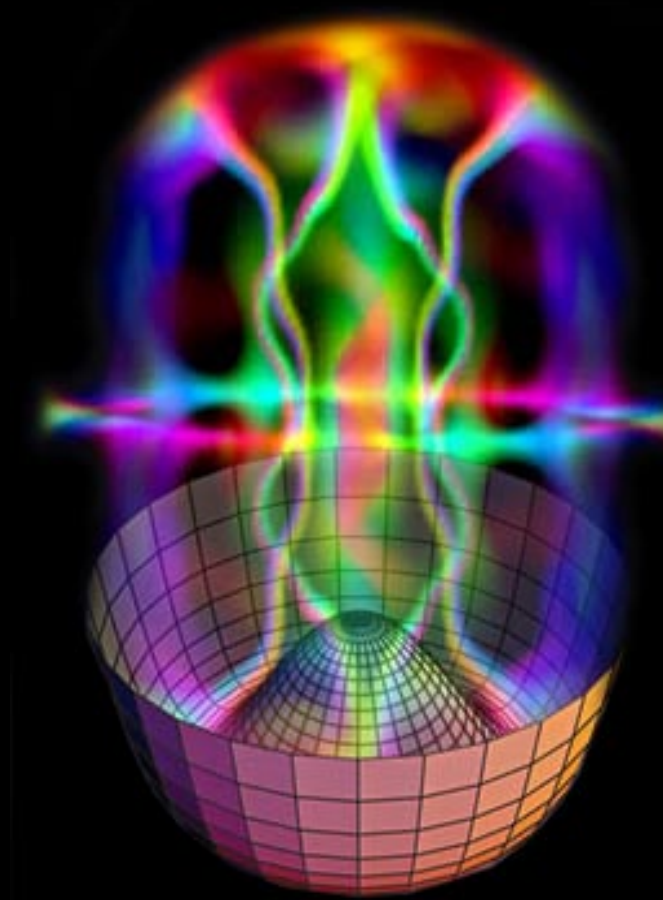
b Bottom

The neutrino masses are extremely small; they are known to be less than 1/150 of the electron mass.

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Higgs Boson

Professor Peter Higgs proposed that all of space is permeated by a field, the Higgs field.



The Higgs field, responsible for the mass of all particles, fills the universe.

This image shows a representation of the field.

Quantum theory says that all fields have particles associated with them, so...

in this case...a **Higgs Boson**.

In 2004, the Wolf Foundation Prize in Physics was awarded to Robert Brout, François Englert, and Peter Higgs for "pioneering work that has led to the insight of mass generation".



The Higgs has already been discovered at the ATLAS Experiment, but it was Prof. Higgs, ...not the Higgs Boson.

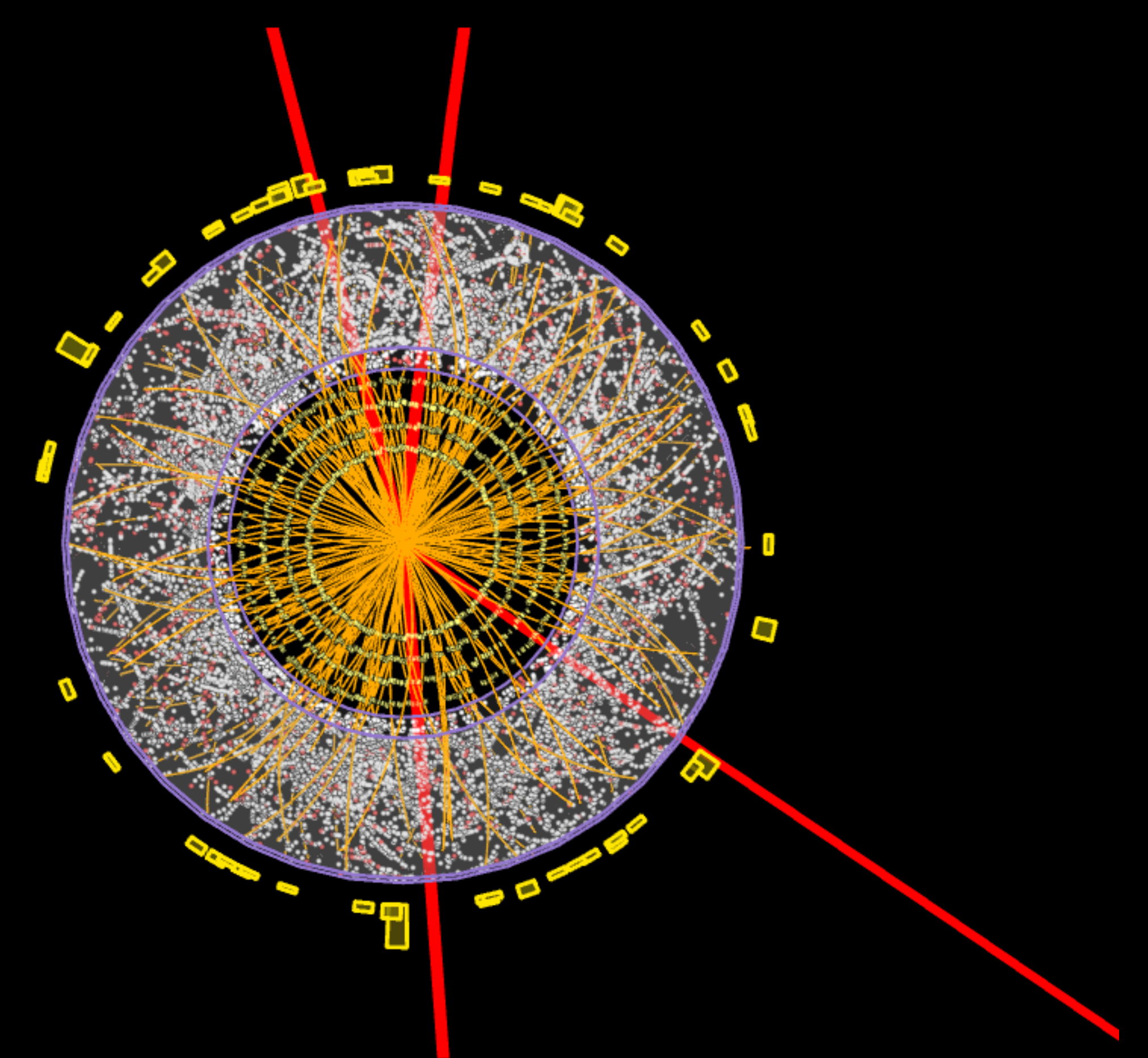
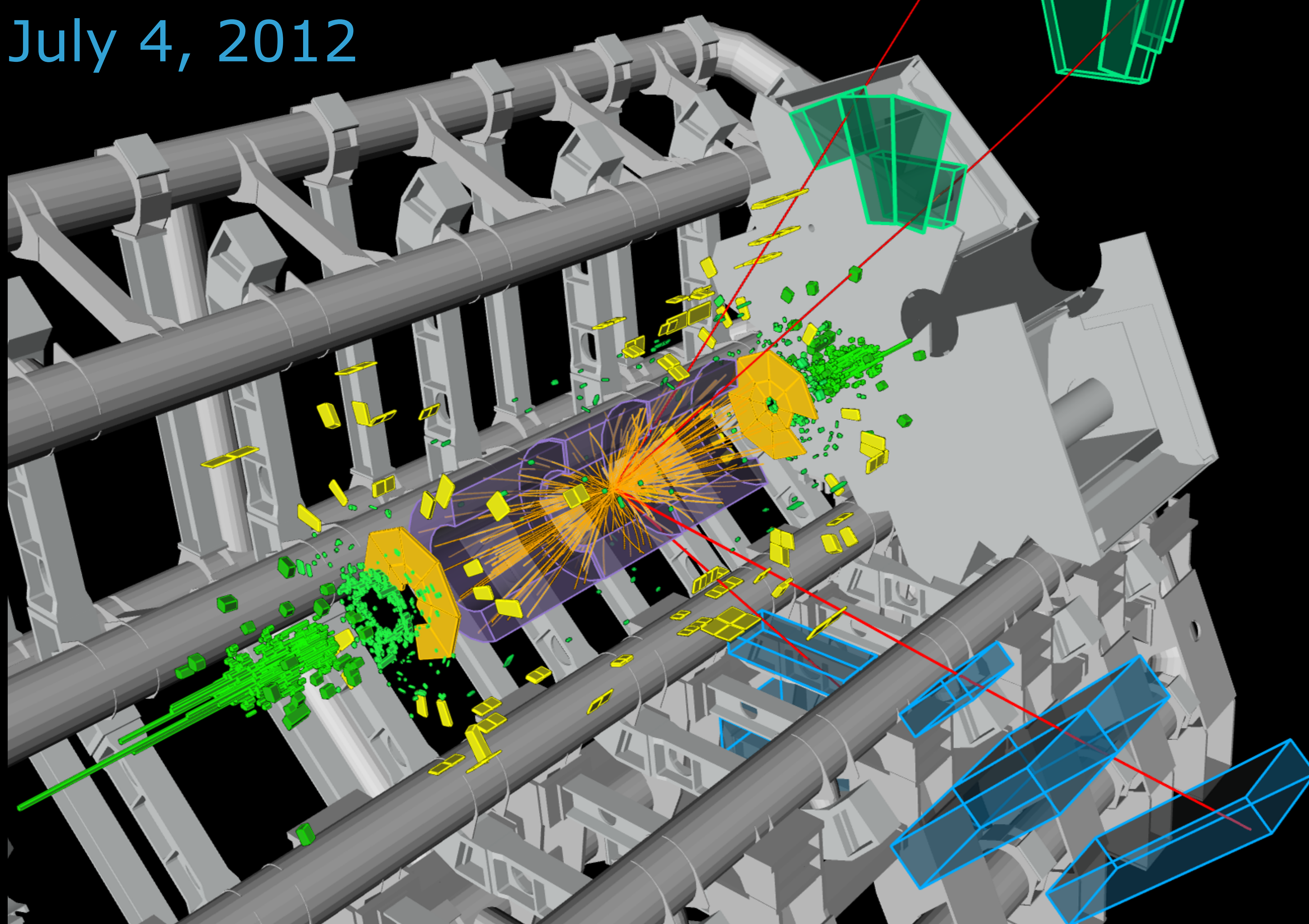
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Discovery & Nobel Prize



July 4, 2012

ATLAS
EXPERIMENT
<http://atlas.ch>



A collision in the ATLAS detector identified in the search for Higgs boson.

Run: 204769
Event: 71902630
Date: 2012-06-10
Time: 13:24:31 CEST






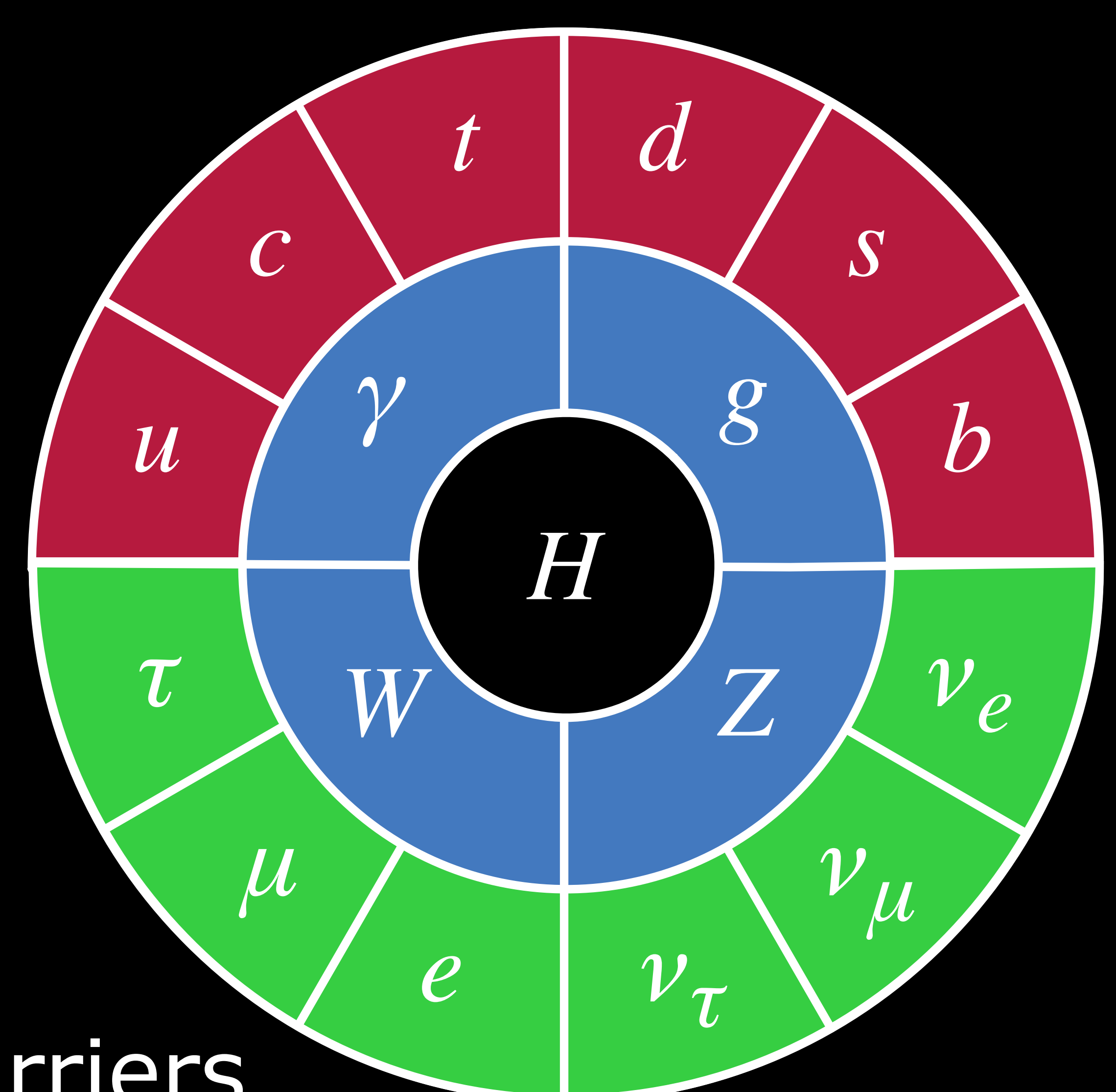
The **Nobel Prize in Physics 2013** was awarded jointly to **François Englert** and **Peter W. Higgs**

*"for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the **discovery** of the predicted fundamental particle, by the **ATLAS** and **CMS** experiments at **CERN's Large Hadron Collider**"*

The Standard Model

The discovery of the Higgs boson completes the **Standard Model** of fundamental particles; however, we know this theory is **not complete**. For instance, it does not explain **dark matter** or why there is more matter than anti-matter in the universe.

 quarks
 leptons
 force carriers



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