

# The Higgs Boson

## What is mass?

We still do not understand what mass is and why the quarks and leptons have different masses. Our current best idea is that a "Higgs field" fills the universe and mass is a measure of the resistance to movement through this field.



To understand the Higgs mechanism, imagine that a room full of physicists quietly chattering is like space filled only with the Higgs field ...



... a well known scientist walks in, creating a disturbance as he moves across the room, and attracting a cluster of admirers with each step ...



... this increases his resistance to movement, in other words, he acquires mass, just like a particle moving through the Higgs field ...



... if a rumour crosses the room...

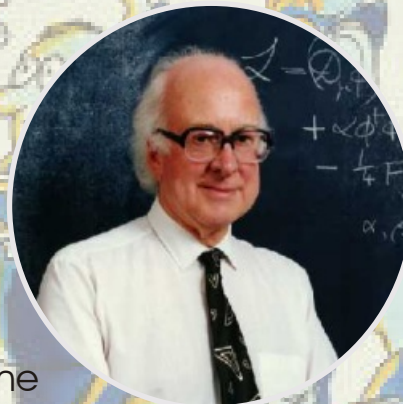


... it creates the same kind of clustering, but this time among the scientists themselves. In this analogy, this cluster is a Higgs particle.

From an idea by David Miller, University College, London.

## Explanation for mass

This explanation for mass was developed in the 1960's by a number of physicists, including Peter Higgs, now Emeritus Professor at the University of Edinburgh, whose name has been associated with the idea.



Peter Higgs

Many searches have been made for the Higgs boson; the most detailed were using the LEP accelerator at CERN during the 1990's. Indirect evidence suggests it has a mass lower than  $200 \text{ GeV}/c^2$  and direct searches show that its mass is above  $110 \text{ GeV}/c^2$ .

In 2000, physicists at LEP may have glimpsed the first hints of a Higgs boson signal: a few events consistent with a mass of  $115 \text{ GeV}/c^2$  were observed.

## Possible evidence

for the Higgs boson in the ALEPH detector at LEP in the reaction  $e^+e^- \rightarrow HZ$ .

The Higgs boson has decayed into the green and yellow jets, the Z boson to the red and blue jets. It is also possible, however, that other processes could be responsible for this event. The LHC is expected to resolve the puzzle after it begins operation in 2006.

