

The discovery of the Standard Model Higgs boson and its properties

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The observation of the Higgs boson with the ATLAS detector in 2012 was a major achievement for science. This essay is aimed at understanding the relevance of the Higgs boson in the Standard Model and analysing the experimental observation of the particle. The dataset used in the experiment had an integrated luminosity of about 25 fb^{-1} at the centre-of-mass energy of $\sqrt{s} = 8 \text{ TeV}$. To understand how the ATLAS detector works to identify a particle, the $Z \rightarrow e^-e^+$ decay is used as an illustration. The Z boson mass is measured to be $m_Z = 91.53 \pm 0.12 \text{ GeV}/c^2$ with the width of $\Gamma_Z = 3.56 \pm 0.89 \text{ GeV}/c^2$. The Higgs boson analysis is done using only the data from the $H \rightarrow \gamma\gamma$ channel. The results are examined in a statistical test with two hypotheses. The statistical results show the presence of a particle at $126 \text{ GeV}/c^2$.

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