

<http://www.phys.uu.nl/~thoof/home.html>

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## Will the Higgs be found?

**More and more frequently**, I receive letters and mails from wise people outside physics, telling me that "they know" that the Higgs will not be found, that our theories are baloney, how dare we spend billions of public funds to build machines such as LHC, "to prove, against better judgment, that our theories still stand a chance of being correct", and so on.

Well, lads, I am not going to answer all of you in person. What you have in common is a blissful ignorance of the scientific facts concerning the Standard Model. Fact is that the  $W^+$ ,  $W^-$  and the  $Z$  boson each carry three spin degrees of freedom, whereas the Yang-Mills field quanta, which describe their interactions correctly in great detail, each carry only two. Those remaining modes come from the Higgs field. What this means is that three quarters of the field of the Higgs have already been found. The fourth is still missing, and if you calculate its properties, it is also clear why it is missing: it is hiding in the form of a particle that is difficult to detect. LHC will have to work for several years before it stands a chance to see the statistical signals of this Higgs particle. What compounds the matter even more is that there may well be several sets of Higgs fields. If there are two, which is eight quarters of the field, we will get five Higgses rather than one. This would be a quite realistic possibility but it would make the detection of each one of them even harder, because they cause more complex statistical signals that are more difficult to predict.

Theories without any Higgs particle are possible but ugly and have been practically ruled out by observations. In such theories, composite bound states of other particles have to play the role of a Higgs, which requires the existence of very strong new interactions, of which there is presently no evidence at all, and it would make the perfect agreement found today between observations and the Standard Model highly improbable.

If no Higgs is found at all, and all present ideas would be ruled out by LHC - which is unlikely - this would in no way make LHC useless. Quite to the contrary, this would lead to lots of work for theoreticians to do, and, more importantly, this would imply the existence of new strong forces with a plethora of highly interesting particles just round the corner, waiting to be discovered by LHC or its successors. There's no way that this field of research can become dull.

My special greetings to visitor number 526952(since 25/10/99)

*If this page looks messy it is because I only have access to an inferior Microsoft product to design it. My apologies.*

*Last revised: May 12, 2010.*