Special Report

Higgs excluded from 130 GeV to 480 GeV

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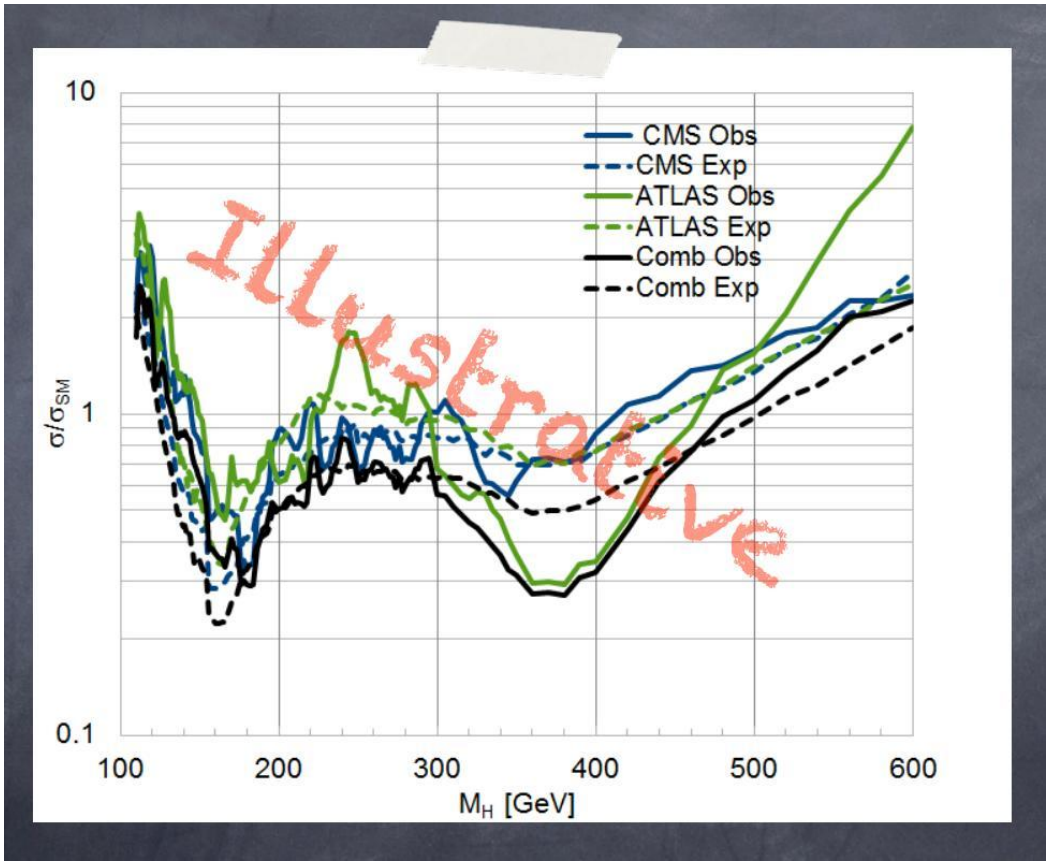
Abstract

There are a few interesting workshops and conferences on today that are presenting results from LHC and Tevatron. In particular the "Implications of LHC results for TeV-scale physics" meeting at CERN all this week is the most likely place to look for new results.

Key Words: LHC, Tevatron, CMS, ATLAS, CERN.

Indeed the following plot has just been shown by Eilam Gross.



This is an "illustrative" combination of the ATLAS and CMS Higgs searches which appears to be based on the data presented at lepton-Photon-2011. If you look carefully at where the black line crosses the 95% confidence level limit you will see that it excludes the standard

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model Higgs between 130 GeV and 480 GeV. This is slightly stromger than the unofficial version I put together last week.

A Higgs below 130 GeV disfavors the standard model on its own because of vacuum instability. It might be OK if the vacuum remains metastable with a sufficiently long lifetime but if the mass is a bit smaller then such a universe becomes a very dangerous place to live. The safer explanation would be that the light Higgs is stabilized by extra particles which would have to look very much like a Higgsino or a stop, i.e., SUSY.

The excesses above 130 GeV are still there. It is difficult to read their size from this plot but they are obviously not due to a standard model Higgs. They could be from another boson with a smaller cross-section, or they may just be the effects of uncertainty in measuring the missing energy of the neutrinos in the WW channel.

No doubt more data will be added soon and some possibilities are:

- Excesses at 120 GeV could grow to a robust signal of a light Higgs, suggesting supersymmetry
- The curve may continue to descend until the whole mass range is excluded according to the standard model
- The 140 GeV excess could bounce back up from the grave to provide a standalone Higgs boson solution
- The Higgs could appear at higher mass than 480 GeV, posing other problems for the standard model.
- Some completely unexpected signal of electro-weak symmetry breaking could emerge.

Of course the plot is marked as “Illustrative” and I have no idea what other caveats the speaker has added.

References

1. http://blog.vixra.org/2011/08/29/higgs-excluded-from-130-gev-to-480-gev/