We have found **a** boson, what next?.

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More information available: "The large Hadron Collider: Higgs hunting gets serious" Current Science, **101**, No. 9, 1155.

a The journey of the 'Higgs boson' from an 'idea' to a 'reality'.

b What is the implication of the discovery of the boson announced on July 4?

c **Whither from here?**

What is the World around us made up of?

An AGE OLD QUERY:

- How do things around us work? What are they all made of?
- Is everything made up of the *same* ultimate units? If so, what holds them together?

What are the bricks and mortar of edifice of life?

- The question has remained the same through the ages.
- Answers have changed. Our perception of what the parts are has changed as our understanding of how the parts are put together has grown!

Efforts to answer this question $\Rightarrow$ the development of Science.

'Elements' $\rightarrow$ Chemical elements $\rightarrow$ molecules $\rightarrow$ atoms $\rightarrow$ nuclei $\rightarrow$ quarks, leptons,..

$\Downarrow$

Elementary Particle Physics

The accepted world view:

Fundamental Particles are the quarks, the leptons and gauge bosons which carry the forces: the photon, the W/Z-boson, the gluon

and

the Higgs Boson.

Laws of particle physics which we have found to be functioning at distance scales of fermi's and smaller, seem to be of relevance in addressing things that happen on cosmological time (say beginning of the universe) and astronomical distance scales (millions of mega parsecs and above!)

How was everything formed?

How did the nucleons form? Can we explain the relative abundance of different elements in the Universe? (stars, galaxies...)

These questions are understood in terms of known physics of the Standard Model (SM) of Particle Physics!

The Standard Model (SM) of particle physics:

The candidate for **the** 'theory' of the fundamental particles and interactions among them!

Built, brick by brick, over the last 50-60 years, combining information from a lot of different types of experiments and many many innovative theoretical ideas.

The basic mathematical framework is that of quantum field theories (QFT) which possess some special properties (symmetries).

Among the Nobels awarded for physics till to date,

15 are for experimental discoveries OR theoretical breakthroughs that have contributed to the Standard Model.

First in 1936 and the most recent one in 2008.!

The Standard Model(SM) as it stands has been checked with a very high degree of precision as the properties of various particles and rates of their production/decay in a large number of exepriments agree well with the theoretical predictions.

In one case a quantity called gyromagnetic ratio for the μ has been measured to 11th decimal place and the measurement agrees with prediction which has also been done to 10 th decimal place.

So this is precision theory and precision experiment.

The precision theory makes sense ONLY if a Higgs boson exists.

Search for the Higgs at the LHC is indeed the last station in this journey on the SM road.

We want to follow the transformation of the 'Higgs particle' from purely an idea to a 'physical reality' being searched for at the LHC!

The 'Periodic Table' of Fundamental particles and their interactions has arrived!

FERMIONS matter constituents
spin = 1/2, 3/2, 5/2, ...

Leptons spin =1/2

Flavor	Mass GeV/c^2	Electric charge
ν_L lightest neutrino*	$(0-0.13)\times10^{-9}$	0
e electron	0.000511	–1
ν_M middle neutrino*	$(0.009-0.13)\times10^{-9}$	0
μ muon	0.106	–1
ν_H heaviest neutrino*	$(0.04-0.14)\times10^{-9}$	0
τ tau	1.777	–1

Quarks spin =1/2

Flavor	Approx. Mass GeV/c^2	Electric charge
u up	0.002	2/3
d down	0.005	–1/3
c charm	1.3	2/3
s strange	0.1	–1/3
t top	173	2/3
b bottom	4.2	–1/3

BOSONS force carriers spin = 0, 1, 2, ...

Unified Electroweak spin = 1

Name	Mass GeV/c^2	Electric charge
γ photon	0	0
W^-	80.39	–1
W^+ W bosons	80.39	+1
Z^0 Z boson	91.188	0

Strong (color) spin =1

Name	Mass GeV/c^2	Electric charge
g gluon	0	0

On 4th July high energy physicists announced discovery of a new boson, a particle with spin which is an integral multiple of $\frac{h}{2\pi}$, which is NOT 1 at the Large Hadron Collider: LHC!

The SM periodic table in SM-2013 may well look like this:

BOSONS spin = 0, 1, 2, ...

Unified Electroweak spin = 1		
Name	Mass GeV/c^2	Electric charge
γ photon	0	0
W^-	80.39	−1
W^+ W bosons	80.39	+1
Z^0 Z boson	91.188	0

Strong (color) spin =1		
Name	Mass GeV/c^2	Electric charge
g gluon	0	0

Spin ≠ 1		
Name	Mass GeV/c^2	Electric Charge
H^0	about 125	0

Very much looked for,guided by all the earlier knolwedge of constituents and their dynamics

The chapter on Standard Model in the book of particles is just about to be closed!

We want to follow this from the beginning.

Higgs boson is a fundamental particle with intrinsic spin angular momentum zero i.e. a scalar boson, which **MUST** exist if the currently accepted explanation of fundamental constituents of matter and interactions among them is **CORRECT**.

This is the last piece of this wonderful jig-saw puzzle that the particle physicist put together!

Let me go back a century and see in the past what was the time lag between the existence of a new particle and the acceptance by community that it is 'reality'.

First elementary particle to be discovered : an electron

Electrons: a very rapid transition from being a "mathematical entity" to a "physical reality" :1897.. $>$ 1899.

Three basic processes to arrive at the electron as a constituent

1) Observation by Farady that the electricity comes in units from patterns in ionisation

2) The experiments made by Thompson that Cathode rays behave under the action of electric and magnetic fields as though they consisted of particles with a ratio of charge to mass (the famous e/m) quite different from the Hydrogen ion,

3) The measurement by Zeeman of the splitting of the atomic spectral lines in a magnetic field and finding a value in agreement with that predicted using ideas by Lorenz, if an electron with that value of e/m should exist inside an atom.

Essential role played by the knowledge of the dynamics.

The counterpart of Faraday's observation of patterns and Thompson's discovery was

A 'model' for a unified description of the weak and electromagentic interactions.

Since then has been termed the 'Standard Model'

This was the Glashow-Weinberg-Salam Model!

Story really begin with Enrico Fermi (Nobel Laurate) around 1950.

He had a theory of β decay of nuclei. It worked beautifully for explaining the life times of β decay of ALL the nuclei in terms of the nuclear disentigration energies and a SINGLE constant which we call $G_F = 1.01 \times 10^{-5}/M_p^2$. $(M_p c^2 \simeq 1\text{GeV.})$

But the theory produced nonsense when used for predicting rates for processes involving scattering of particles of high energy!

What did it do?

Predicted probabilities greater than 1 for 'thought' experiments involving $\nu p \to en$.

Attempts to sort this problem out implied that the carriers of weak interactions (W/Z) had to be massive.

But their massive nature again predicted probabilties greater than 1 for processes like $\nu\bar{\nu} \to W^+W^-$.

Glashow suggested a solution using ideas of symmetries of interactions! **Counterrpart of Faraday's observation of patterns!**

This predicted existence of a new particle and a new interaction!

But the mathematical formulation did not make sense if the carriers were massive!

It produces infinities when one tries to predict rates of reactions accurately.!

AND

Predicted probabilities **greater than 1** in a thought experiment of $e^+e^- \to W^+W^-$ at Astronomically high energies!

This is where M/s Higgs, Englert, Brout, Kibble, Hagen and Guralnik make the apperance.

They invented a mechanism which can make the gauge bosons massive without having all these problems!

The mechanism called **Higgs mechanism** predicted existence of a spin zero particle. (Explicit mention of a particle only in the paper by Higgs.)

It is the interaction with of the W/Z with this spin zero particle (the Higgs boson) that made a nonzero mass for them possible still keeping the symmetry (patterns proposed by Glashow) intact!

This is called 'spontaneous symmetry breaking' and they used a mechanism invented by Nambu who got the Nobel prize in 2008.

An example existed from Superconductivity.

All of us know that electromagnetic fields penetrate only a small distance inside the superconductor!

It is as though the photon developes a mass in the superconductor!

In particle physics it is happening in 'vacuum' **NOT** 'inside' a medium
This requires existence of a new particle the Higgs boson!

What does it mean when we say that Higgs boson gives masses?

What it really means is that these interactions of the matter fermions and the bosons W/Z with Higgs bosons make the existence of a nonzero mass for them consistent with different symmetries.

What will go wrong it the theory does not have these symmetries?

The theory HAS to have these symmetries if the quantum formulation of the theory has to make sense!

’t Hooft and Veltman (Nobel laurates: 1995) in fact proved that the qunatum formulation of the theory makes sense **ONLY IF** it has the symmetries & a particle with properties of the Higgs boson exists.

This was enough to convince theorists that this idea had to be correct!

Please note that there are two different ideas:

1)Unified mathematical description of electromagnetic and weak interactions based on symmetry principles. The W/Z in these theories are **necessarily** massive.

2)Existence of a Higgs boson with properties such that it can explain the nonzero masses of matter particles and force carriers in a manner such that the calculations do not yield nonsensical results.!

While the demonstration by ’t Hooft and Veltman was enough to convince theorists of the ’reality’ of the idea of the Higgs bosons it is NO proof!

The proof came from ‘ agreement of the data with theory predictions which was celebrated in Nobel prizes for Weinberg, Salam and Galshow and later Carlo Rubbia, Van der Meer and ’t Hooft, Veltman.

The Rubbia, van der Meer and GSW Nobel Prizes is the first step and ’t Hooft, Veltman, Nambu Nobel prizes is the second step.

Let us follow the first step.

A very long story! from 1967 to 2012! Unfair to summarise it all!

Milestones:

1)Discovery of a new type of weak interactions as predicted by Glashow's model in 1973!

2)Prediction of the existence of a fourth quark with charge $2/3|e|$ and interactions with the W/Z just like the u quark.

Even better, its mass was predicted from observed rate at which a neutral particle K_0 converts itself into another particle $\bar{K}_0$. (Glashow, Illiopoulos, Maini and M.K. Gaillard, B. Lee)

Experimental Observation of this 'charm' quark in November 1974!

3)Glashow/Weinberg/Salam theory predicted masses M_W and M_Z in terms of

a)electron charge b)half life on muon AND c)one free parameter called $\sin\theta_W$.

Good point was that their model also told how to extract this $\sin^2\theta_W$ using high energy experiments involving ν_e, ν_μ and e^-, e^+, protons and neutrons.

Third milestone: the Nobel Prize to Glashow, Weinberg and Salam in 1979 for the correctness of their idea of 'Electroweak Unification'.

This did not quite test the existence of the Higgs.

Determine $\sin^2\theta_W$ using data from

1) $\bar{\nu}_\mu e^- \to \bar{\nu}_\mu e^-$; 2)$\nu_\mu e^- \to \nu_\mu e^-$; 3)$\bar{\nu}_e e^- \to \bar{\nu}_e e^-$; 4) $e^+ e^- \to \mu^+ \mu^-$.

Using this $\sin^2\theta_W$ predict M_W, M_Z.

These relations assume ONLY the symmetry and do not give any information about its Spontaneous Breaking!

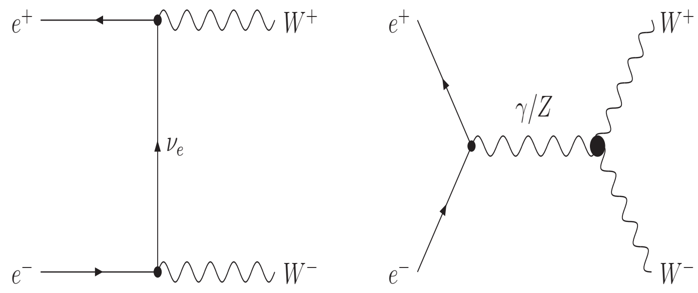
$M_W = 82 \pm 2$ GeV/c^2, $M_Z = 92 \pm 2$GeV/c^2

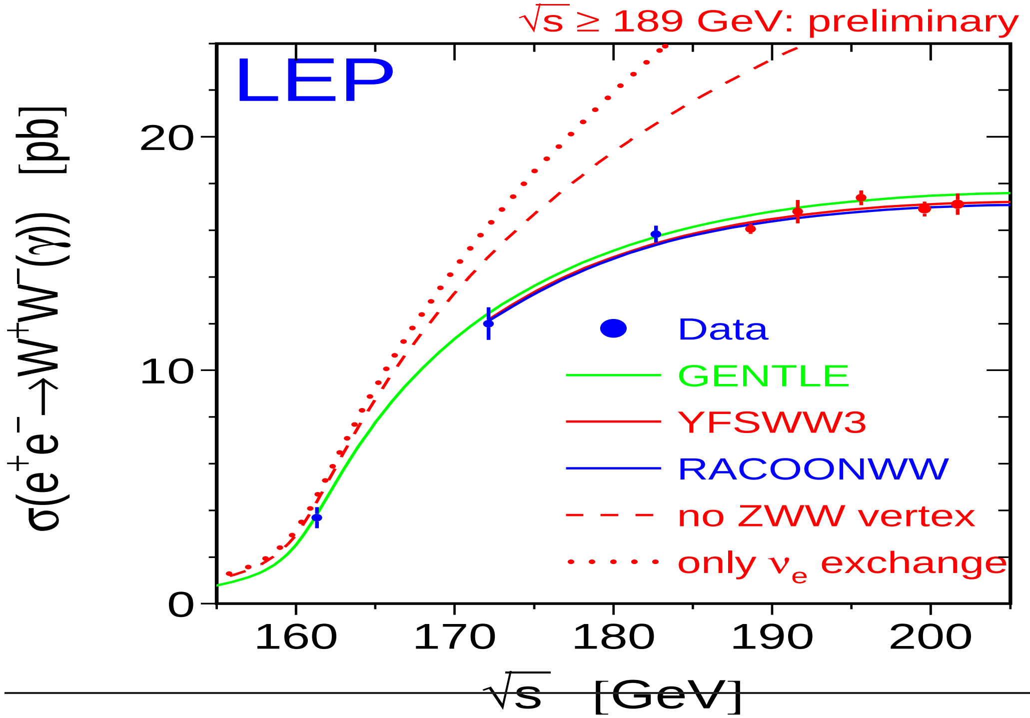
UA-1 and UA-2 experiments found W/Z with these masses,

(Carlo Rubbia + Van der Meer Nobel Prize) (1984)

These predictions did not require 'precision' theory and hence did not say anything 'conclusively' about the Higgs!

Direct 'Proof' of Symmetry and Symmetry breaking!!





Proof that Electroweak symmetry exists and that it is broken.

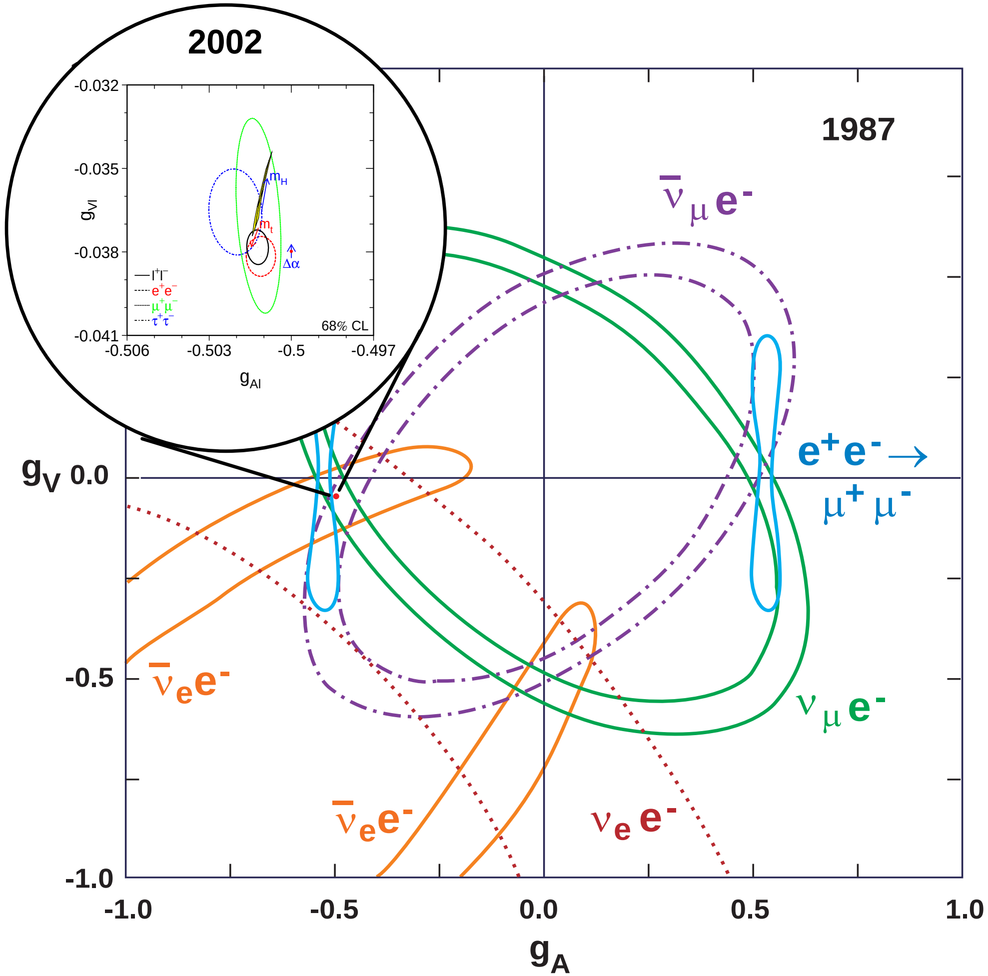
The triple gauge boson ZWW coupling tames the bad high energy behaviour of the cross-section. Direct proof for the ZWW coupling.

This observation at LEP-II and precision measurement of proeprties of the Z boson at the LEP-I, confirm basics of the SM

From 1974 onwards literally thousands of papers written on how to search for the Higgs.

Till now we had only negative results from direct searches.

This is not the place to tell about that!

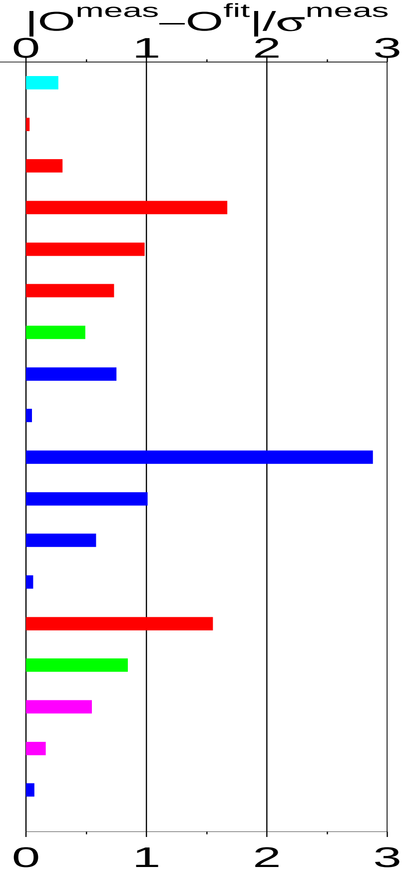


g_V, g_A depend on $\sin\theta_W$!

If one has used the 2002 high precision value of $\sin\theta_W$ and the low precision theory prediction then measured values of M_Z, M_W would not agree with predictions!

High precision calculation require theory to have a Higgs!
Further the results will depend on its mass.!

	Measurement	Fit
$\Delta\alpha^{(5)}_{had}(m_Z)$	0.02750 ± 0.00033	0.02759
m_Z [GeV]	91.1875 ± 0.0021	91.1874
Γ_Z [GeV]	2.4952 ± 0.0023	2.4959
σ^0_{had} [nb]	41.540 ± 0.037	41.478
R_l	20.767 ± 0.025	20.742
$A^{0,l}_{fb}$	0.01714 ± 0.00095	0.01645
$A_l(P_\tau)$	0.1465 ± 0.0032	0.1481
R_b	0.21629 ± 0.00066	0.21579
R_c	0.1721 ± 0.0030	0.1723
$A^{0,b}_{fb}$	0.0992 ± 0.0016	0.1038
$A^{0,c}_{fb}$	0.0707 ± 0.0035	0.0742
A_b	0.923 ± 0.020	0.935
A_c	0.670 ± 0.027	0.668
A_l(SLD)	0.1513 ± 0.0021	0.1481
$\sin^2\theta^{lept}_{eff}(Q_{fb})$	0.2324 ± 0.0012	0.2314
m_W [GeV]	80.385 ± 0.015	80.377
Γ_W [GeV]	2.085 ± 0.042	2.092
m_t [GeV]	173.20 ± 0.90	173.26



March 2011

see http://lepewwg.web.cern.ch

Logical steps in Precision testing of the SM and the indirect limits (tracking the Higgs through pug marks!)

- A large number of EW observables measured quite accurately.

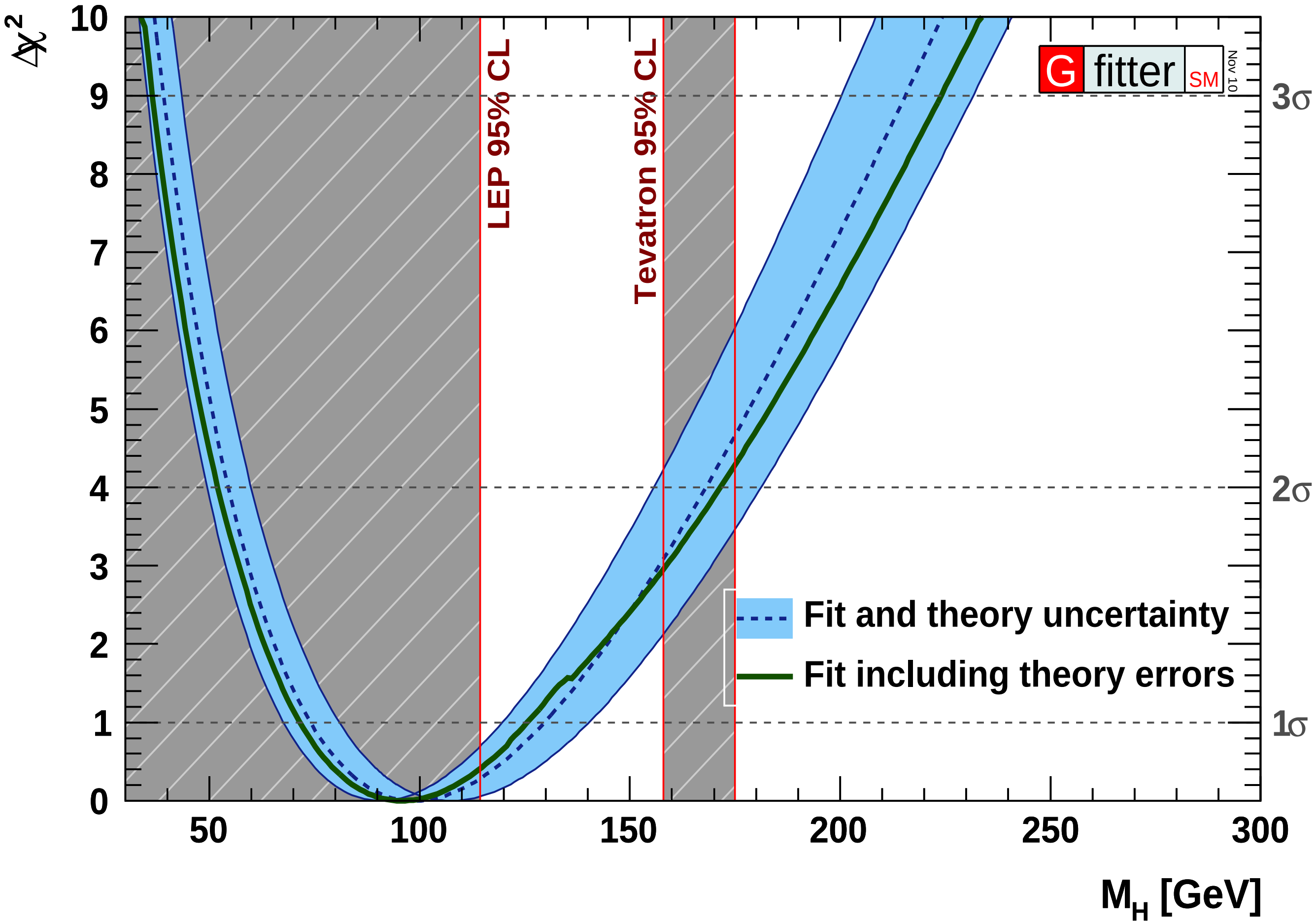
- All are predicted in the SM in terms of measured M_Z, α_{em} and G_F, AND M_f (mainly M_t) *and* M_h.

- Calculate all observables to high precision

- Technical description: **1 loop EW** radiative corrections which can be computed in a renormalisable quantum field theory.

- Compare with data, make a SM fit.

GAVE AN INDIRECT LIMIT ON THE HIGGS MASS IN THE SM.



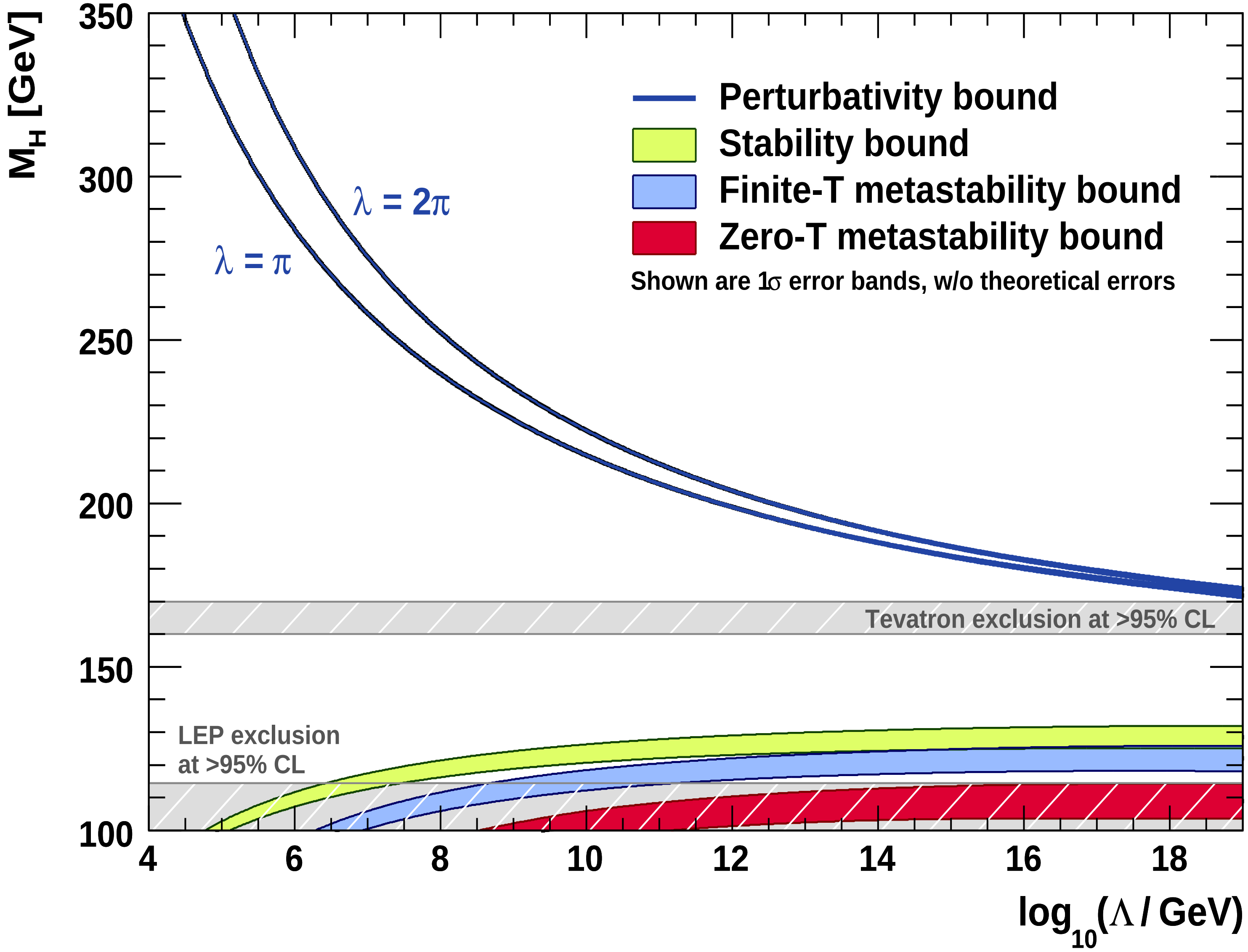
Higgs mass in the SM should be less than 160 GeV (Indirect information!) We knew this before the LHC was turned on!

Theory gives only limits!

One theoretical limit comes from our old friend of requiring probabilites to be less than 1 (unitarity). In fact long back (1977 or so) it was shown by different people that you can prove the theoretical need of a spin 0 state, with the same interactions as the SM Higgs, based on requiring unitarity of $WW \to WW$.

One of these was (then) young Indian: Satish Joglekar Annals Phys. 83 (1974) 427.

It was shown that you can get a limit on m_H by demanding that the '$WW \to WW$ scattering amplitude does not violate unitarity. B.W. Lee, C. Quigg and H.B. Thacker, Phys. Rev. D16 (1977) 1519


M_H [GeV]
350
300
250
200
150
100
4
6
8
10
12
14
16
18
$\log_{10}(\Lambda / \text{GeV})$
$\lambda = 2\pi$
$\lambda = \pi$
Perturbativity bound
Stability bound
Finite-T metastability bound
Zero-T metastability bound
Shown are 1σ error bands, w/o theoretical errors
Tevatron exclusion at >95% CL
LEP exclusion
at >95% CL

So finally the main role of the Higgs is to

1)Make the scattering amplitudes involving gauge bosons in the theory respect unitarity, probabilities are less than or equal to 1! even for massive gauge bosons.

2)Make gauge theories renormalisable and precision calculations possible

At the LHC look for the Higgs.

In fact energy and number of collisions per second (luminosity) was decided so that discovery of a SM Higgs over the entire theoretically allowed mass range is ensured!

Theorists can give bounds on the Higgs mass

They know precisely how the Higgs boson predicted in the Standard Model interacts with **all** the matter particles and W/Z.

This allows us to predict HOW often the Higgs boson can be produced and what will be the relative rates into different types of particles into which it will decay.

Theorists can provide precise theoretical predictions for cross-sections for the Higgs production and decay as well as for the backgrounds!

This has played an important role in the discovery and now will play an even more important role when we want to analyse what are the implications of this signal for the SM and BSM.

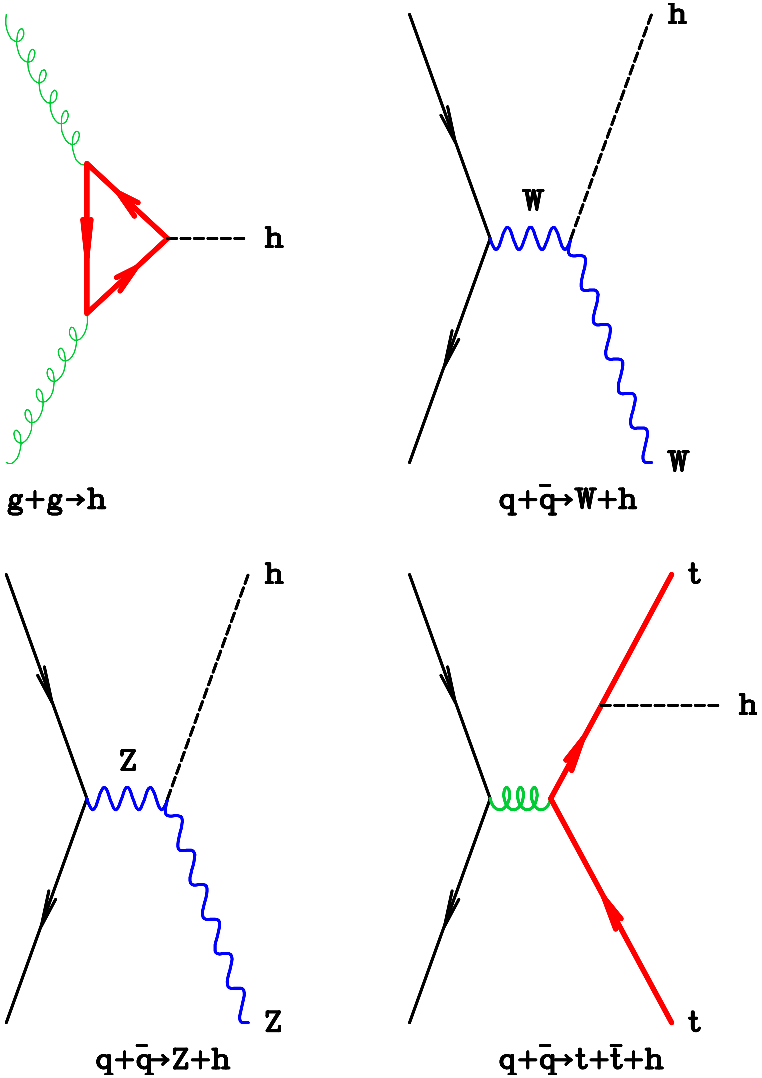
In addition: The observed Higgs mass itself can provide tons of information about SM and BSM.

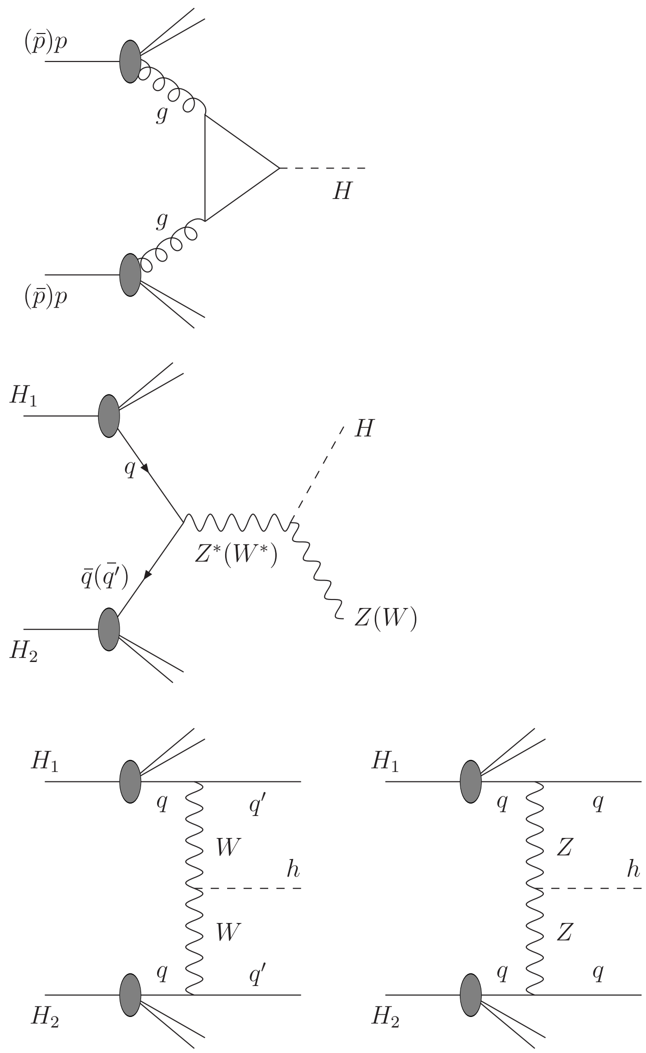
Theorists are able to tell not just how often BUT ALSO what would be the telltale properties of the events ?

You need precision predictions.

An international group of theoretical physicists: Higgs Cross-section Working Group!

Indian theorists have contributed to this effort.


h
W
W
g+g→h
q+q̄→W+h
h
Z
Z
h
t
t
q+q̄→Z+h
q+q̄→t+t̄+h


$(\bar{p})p$
g
g
H
$(\bar{p})p$
H_1
q
H
$Z^*(W^*)$
$\bar{q}(\bar{q}')$
$Z(W)$
H_2
H_1
q
q'
W
h
W
q
q'
H_2
H_1
q
q
Z
h
Z
q
q
H_2

$$\sigma(pp \to X + ..) = \sum_{a,b} \int_0^1 dx_1 dx_2 f_a(x_1, \mu_F^2) f_b(x_2, \mu_F^2)$$
$$\times \sigma(a + b \to X) \left(x_1, x_2, \mu_F^2, \alpha_s(\mu_R^2), \alpha(\mu_R^2), \frac{Q^2}{\mu_R^2}, \frac{Q^2}{\mu_F^2} \right) \quad (1)$$

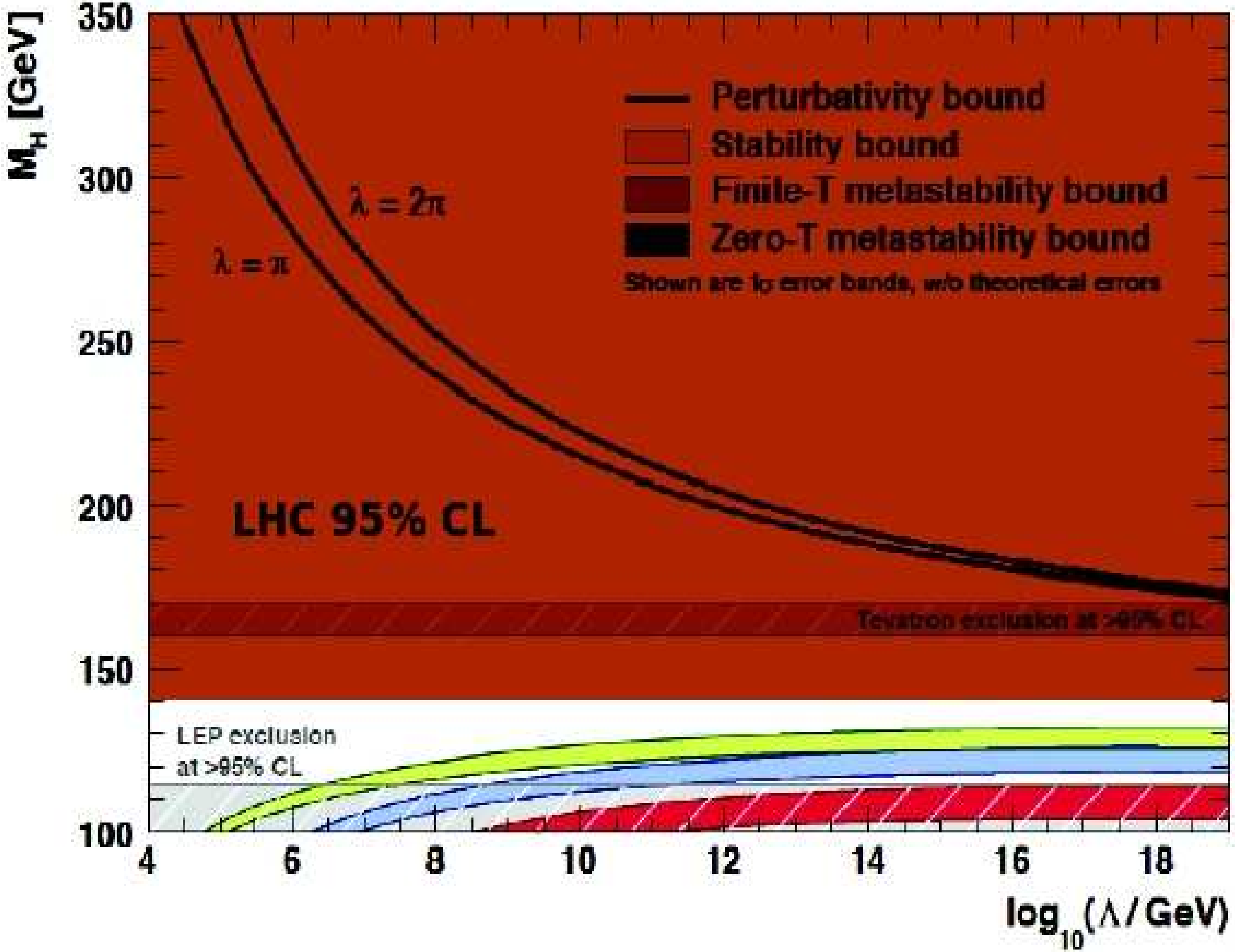
An accurate calculation requires two non-pertrubative inputs: Parton Densities (PDFs) and α_s.

No. of events $= \mathcal{L} \times \sigma$

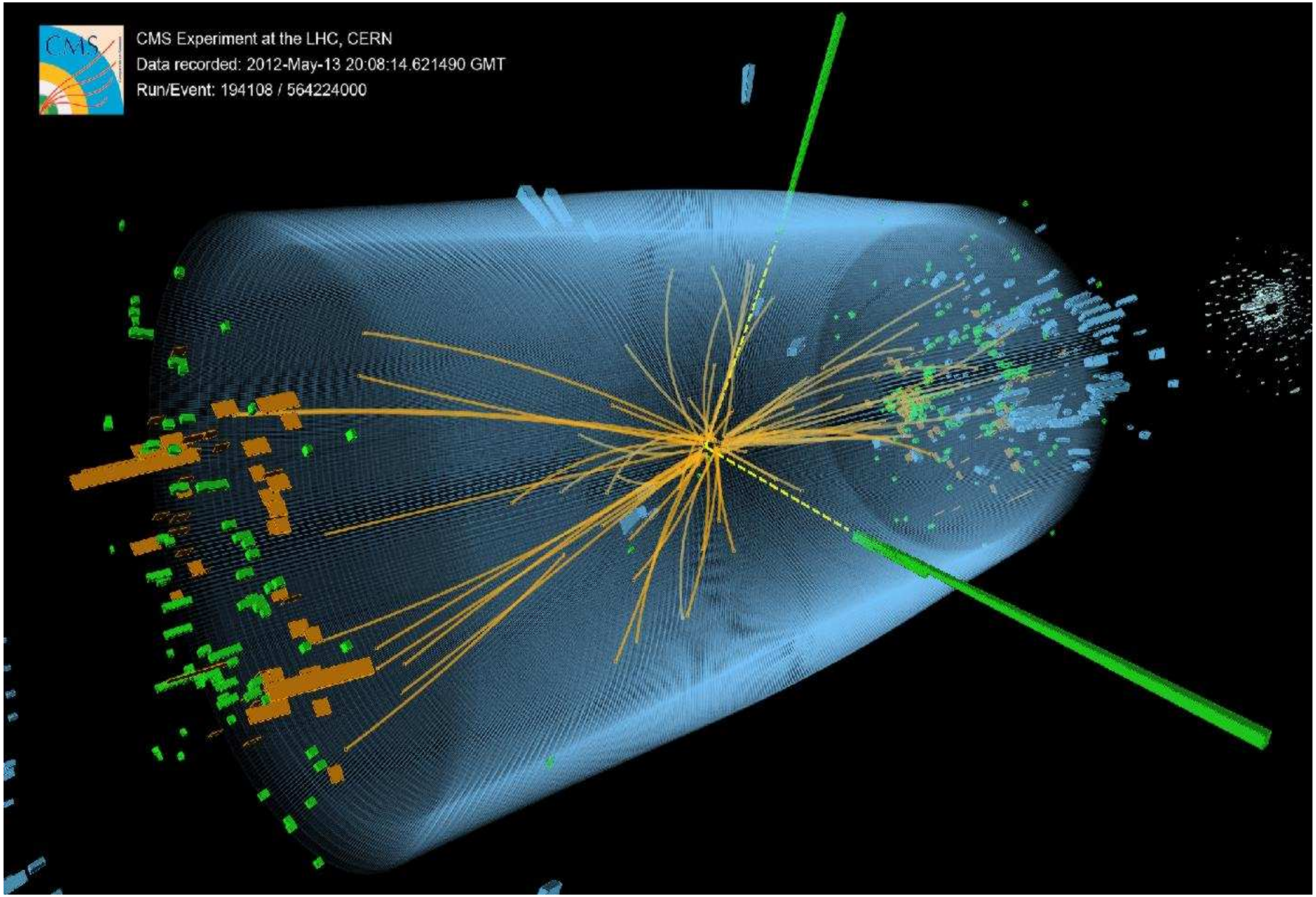
$\mathcal{L} = 10^{33} cm^{-2} sec{-}1 = 1 nb^{-1} sec^{-1} \rightarrow 10 fb^{-1}/yr$

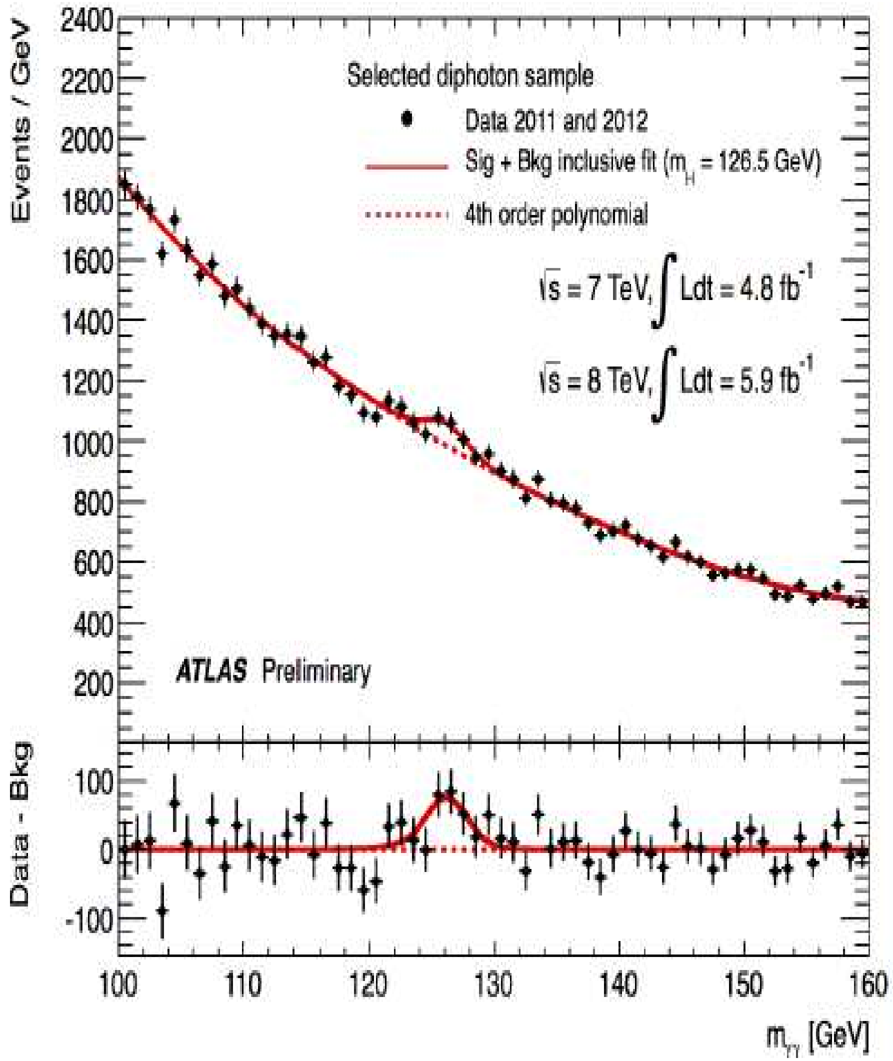
We expect to measure signals which have cross-section of $\sim$ 1 pb or so, giving 1000 events/yr. Cross section for Higgs production for 125 GeV mass is about 20 pb.

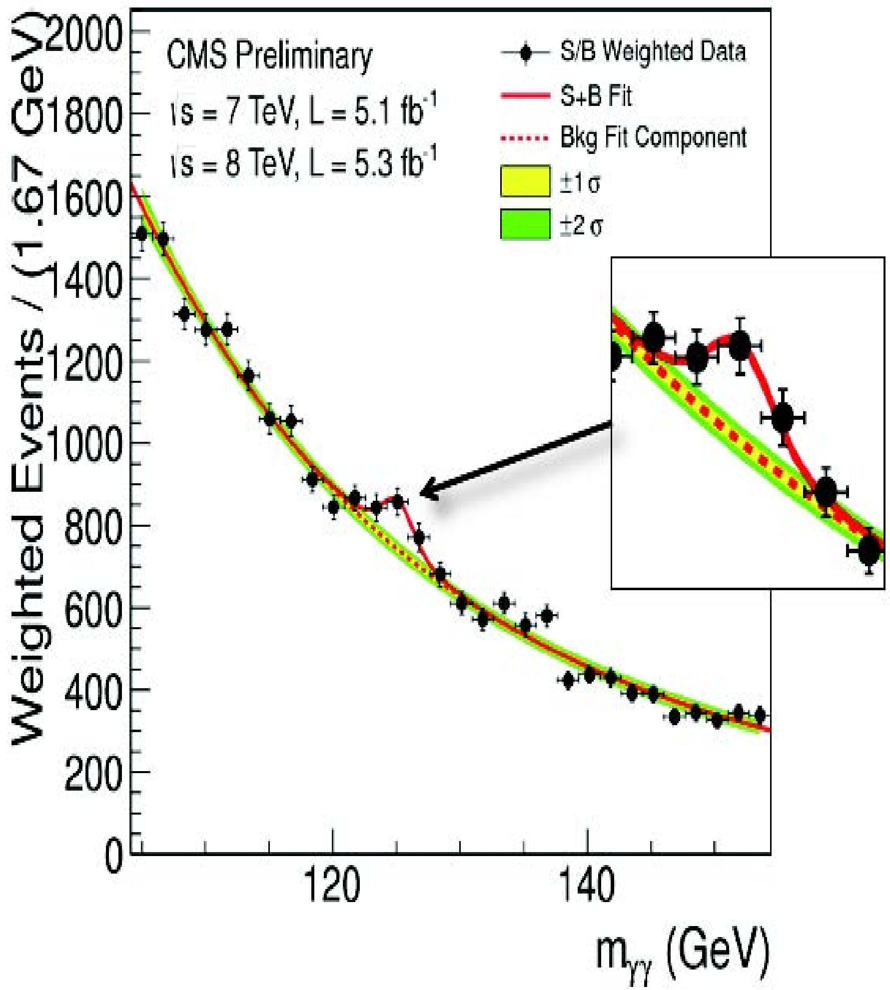
Process	$\sigma(nb) \equiv$ # of events/sec	events/yr
Total cross-sections	10^8	10^{15}
$W^\pm \rightarrow e\nu$	20	2×10^8
$Z \rightarrow e^+e^-$	2	2×10^7
$t\bar{t}$	0.8	8×10^6
$b\bar{b}$	5×10^5	5×10^{12}
central jets ($P_T > 100 GeV$)	10^3	10^{10}
Higgs (125 GeV)	0.02	10^4

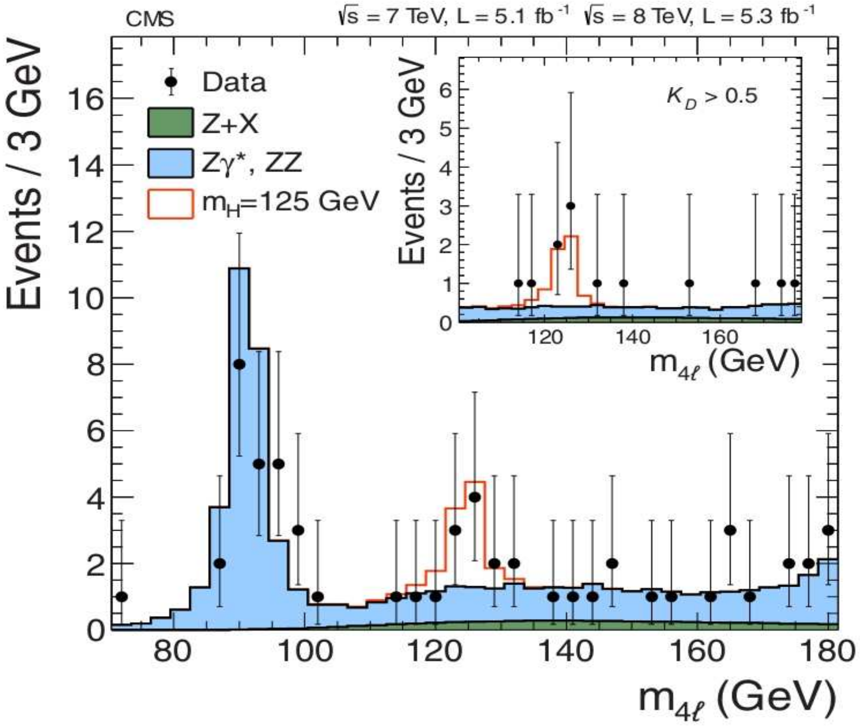


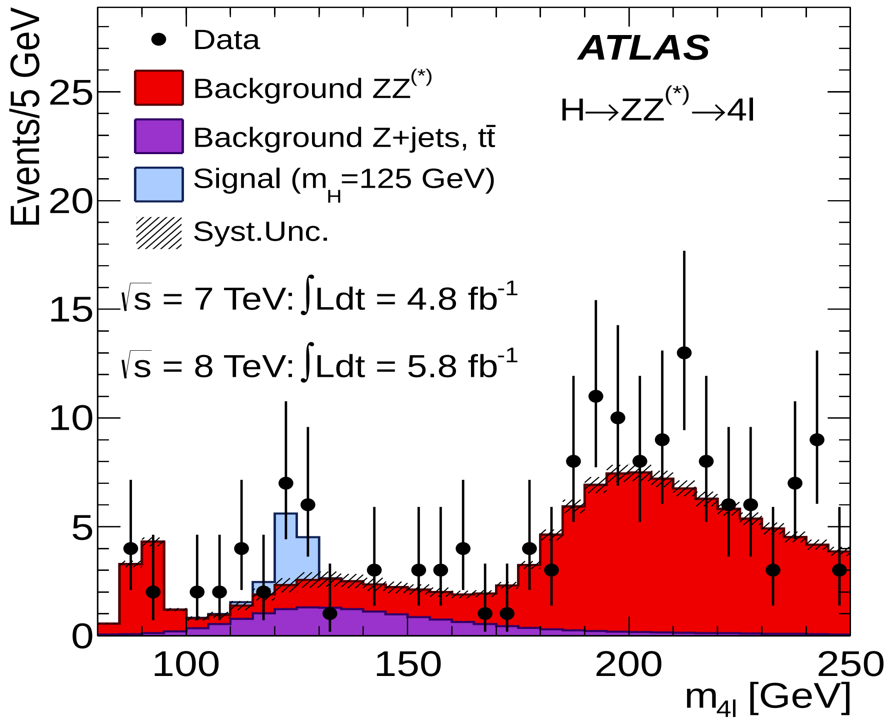
M_H [GeV]
350
300
250
200
150
100
Perturbativity bound
Stability bound
Finite-T metastability bound
Zero-T metastability bound
Shown are 1σ error bands, w/o theoretical errors
λ = 2π
λ = π
LHC 95% CL
Tevatron exclusion at >95% CL
LEP exclusion
at >95% CL
4
6
8
10
12
14
16
18
log10(Λ/GeV)


CMS Experiment at the LHC, CERN
Data recorded: 2012-May-13 20:08:14.621490 GMT
Run/Event: 194108 / 564224000


Selected diphoton sample
Data 2011 and 2012
Sig + Bkg inclusive fit (m_H = 126.5 GeV)
4th order polynomial
√s = 7 TeV, ∫Ldt = 4.8 fb-1
√s = 8 TeV, ∫Ldt = 5.9 fb-1
ATLAS Preliminary
Events / GeV
Data - Bkg
m_γγ [GeV]


CMS Preliminary
√s = 7 TeV, L = 5.1 fb-1
√s = 8 TeV, L = 5.3 fb-1
S/B Weighted Data
S+B Fit
Bkg Fit Component
±1 σ
±2 σ
Weighted Events / (1.67 GeV)
m_γγ (GeV)





Tevatron also has a 3σ result. Signals also in WW.

We seem to have found it! It is light exactly as we wanted! Seems to have interactions with Z, W and t consistent with expectations of the SM. It has mass value that the SM would like it to have!

So is this end of the road?

NO

Is it just beacuse we particle physicists like to keep ourselves employed?

NO

The SM can only predict bounds for the mass of the Higgs.

It has precise predictions for its interactions with the gauge boson and matter particles!

These are predicted in terms of the measured masses M_W, M_Z and M_t etc.

The production rate for the Higgs and the relative probabiltiy for the Higgs to decay into various final states, $WW, ZZ, \gamma\gamma$ etc. decided by these couplings.

Two questions:

• Assuming that this is the Higgs what are the theoretical implications of this mass? For the SM and BSM physics.

• What do we need to do to see if this is the 'standard' scalar or an 'imposter?'

What do we know for sure about the new state?

It has integral spin.

It can not be spin 1 : Yang's Theorem.

Observed information on relative rates of $\gamma\gamma$, ZZ events consistent with loop induced coupling to $\gamma\gamma$ and tree level to ZZ. $\Rightarrow$ has to be dominantly CP even.

Observation in the WW channel crucially uses the spin 0 nature of the higgs to reduce the background!

Consistency between the WW and the ZZ channel also is a strong indications against spin 2.

Clearly much work is required! lot is going on!

(1208.2692,1208.4018,1208.4311....

Mass $\sim 125 - 126$ GeV .

Available: mass and rates in different channels:

No SM like state till 600 GeV other than this!

Exclusions for Heavier Higgs state to the level of $0.3\sigma_{SM}$ **Measuring these rates and the decay life time of the Higgs can tell us if this is 'the' higgs or not!**

Flury of papers trying to do this. J. Baglio, A. Djouadi and R.Godbole, Phys. Lett. B 716, 203-207,2012

With the mass of $\sim$ 125 GeV we are very lucky to have all the channels open with significant branching fraction.

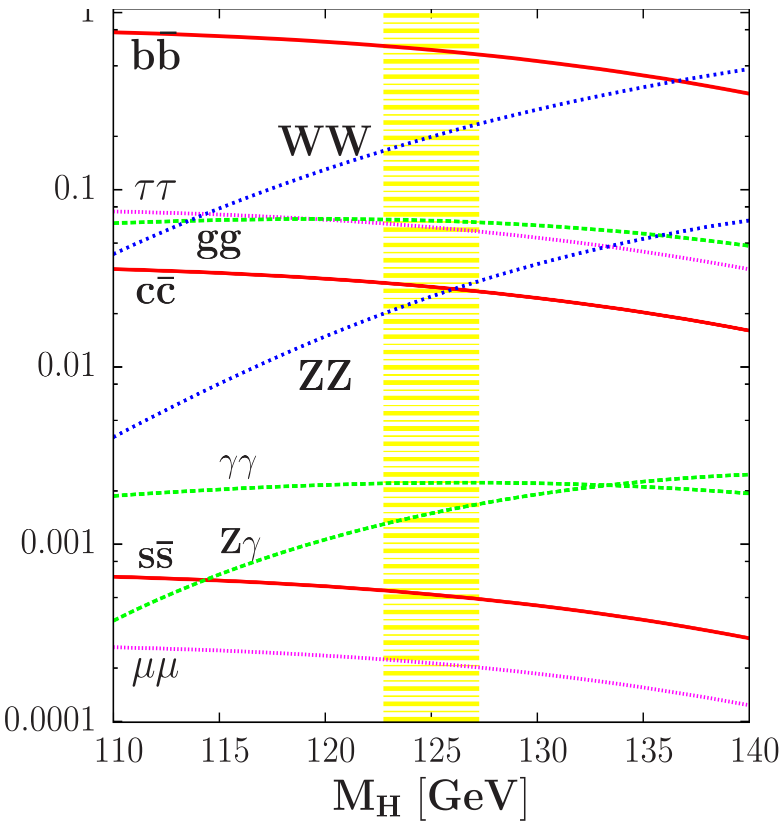


Fig: courtesy A. Djouadi.

Why do we expect something that is 'almost' 'the' higgs but not quite so?

SM does not address the fourth fundamental interaction. The 'oldest' of them all

1. Gravitational Force: The force that holds us on the earth, and gives rise to planetary motion as well as tides.

The first instance of action at a distance!

One of the reasons and motivations to go 'beyond' the SM :BSM

Let me also mention here that

1)There exist lot of things that we can compute in the framework of the SM in practice like the gyromagnetic ratio,

2)Some can be computed only in principle like the mass of the proton. The procedure for the latter is well defined and is a huge computational exercise! Just like protein folding!

BUT There are still some things such as the **Dark Matter DM** in the Universe which as yet find no explanation even in principle in the SM.

A strong reason to suspect there is world Beyond the Standard Model: BSM.

The Higgs boson seems to have a mass which is comparable to M_W and M_Z. We say in particle physics parlance that Higgs is therefore 'light'

But in quantum field theory of spin 0 particles, the quantum corrections allow it to be as large as possible. This NOT the case of gauge bosons or fermions!

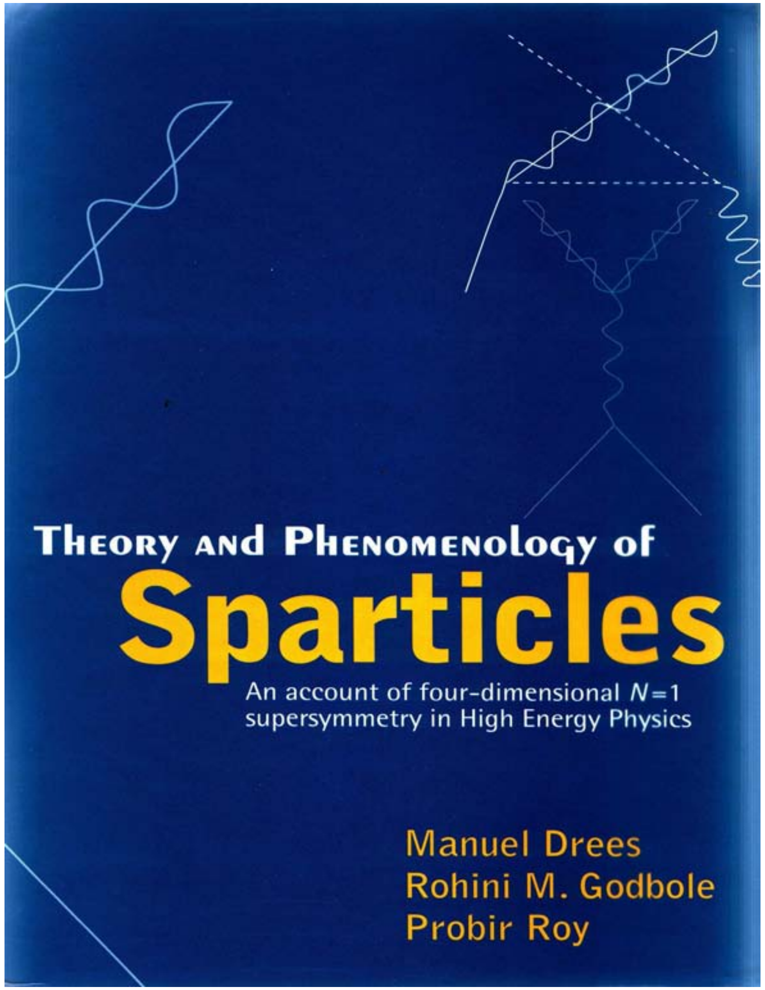
Then we will like to explain 'theoretically' why the observed Higgs boson is light..

This has led to a host of theoretical ideas **beyond** the Standard Model. :BSM.

Almost all the options of going beyond the Standard Model (called BSM) affect Higgs properties such as its interactions with matter particles and the W, Z. So **precision** study of the Higgs sector is THE LHC goal. May be that will shine the path beyond the SM.

May be we will even need a e^+e^- collider for it! (which is under planning and discussion)! **The International Linear Collider: ILC**

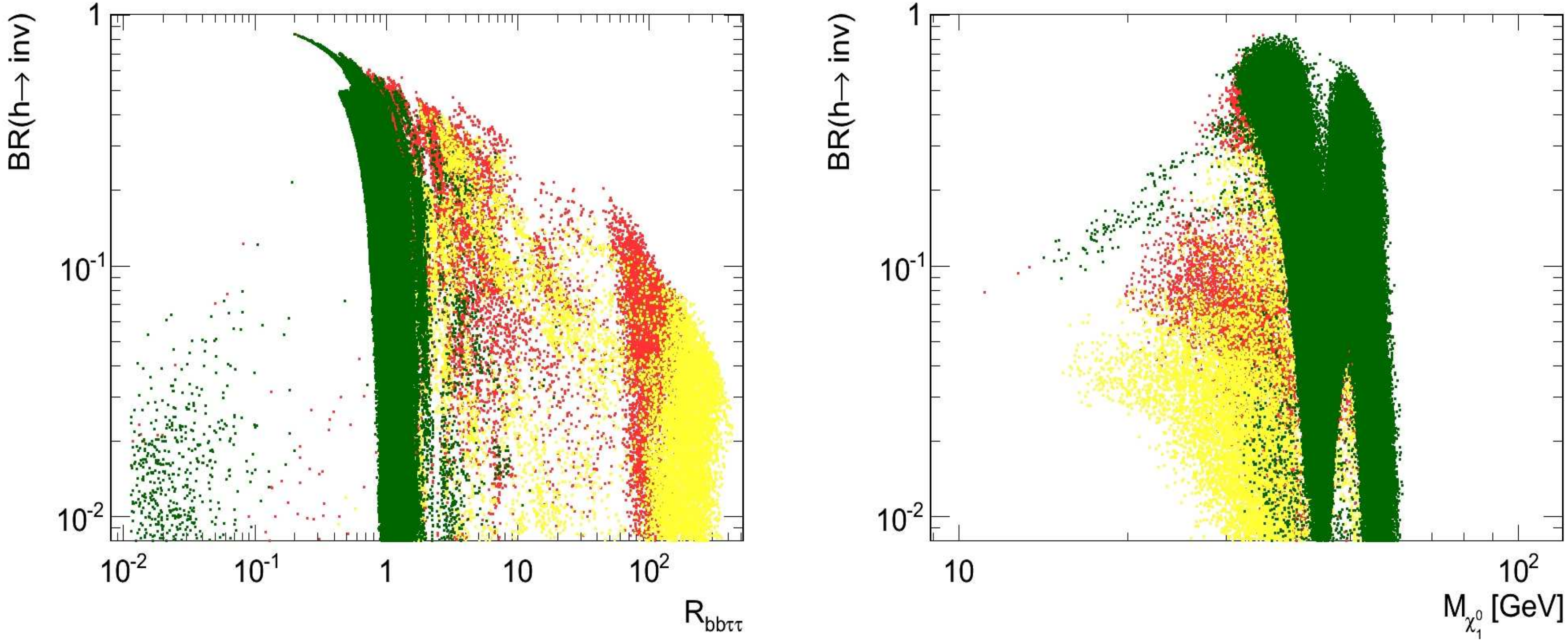
Many ways of extending the SM, which we call BSM physics.
Some involving new symmetries/some without.
Some trying to include gravity in the description.
LHC has not yet given ANY hint for any of these!
May be it is early days yet!
M. Drees, R.M. Godbole and P. Roy, Theory and phenomenology of sparticles, World Scientific, 2005



In supersymmetric theories more than one Higgs particle one of them with properties similar to the SM Higgs boson qualitatively but are different quantitatively.

Further there can even be connection to the candidate Dark Matter Particle.

These are correlated with properties of other particles expected in the theory!



1112.2200 : D. Albornoz Vásquez, Belanger, Godbole.

Thus we can look for SUSY through the Higgs properties even if other new particles are beyond the LHC reach!

An example what theorists do:

Higgs particle is supposed to be even under the reflection in the so called *CP* mirror.

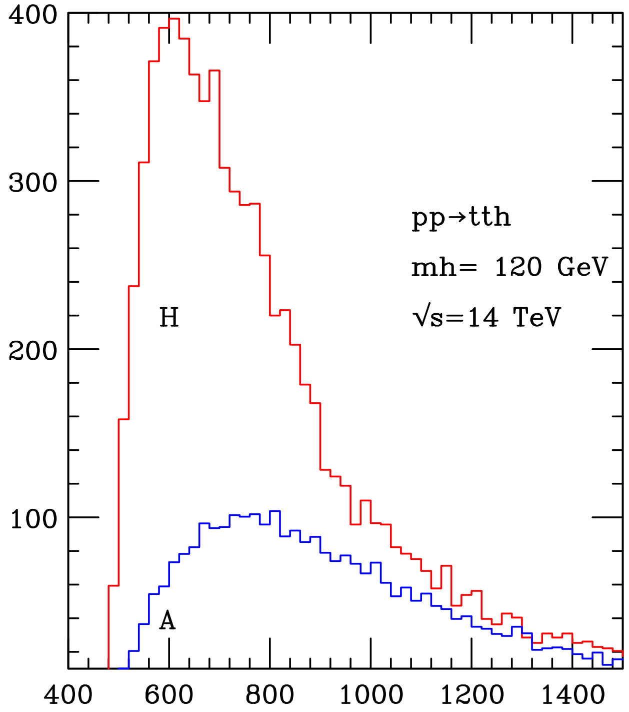
Can we confirm this at the LHC?

If it is neither even nor odd (broken CP symmetry) it might have something to say about our knowledge about the matter antimatter asymmetry in the universe!

How to check this at the LHC?

With my students and collborators I have been studying this issue for the !st few years.

Work in the M.S. thesis of one of the Int. Phd. Student (Bhupal Dev) (Phys. Rev. Lett. 100, 051801, 2008) in fact gave us a clue.



0) We pointed out to experimentalists that if this distribution can be measured we will be able to check the CP of the Higgs. The distribution is some combination of the energy and momenta of all the particles that will be produced.

Clean variable to decide the CP at large luminosity.

In any case the days of Standard Model are coming to an end in some sense!

Hopefully the case will be 'The King is Dead', 'Long live the King'!

The next adventure is just beginning!

Just like the **gauge principle** and the **unitarity** were the guiding principle so far now the **'light' scalar** might be the guiding principle for future developments!

We, particle physicists, hope to get a peek at the BSM land through the 'window' of measurement of the properties of the Higgs!

Exciting days ahead for sure!