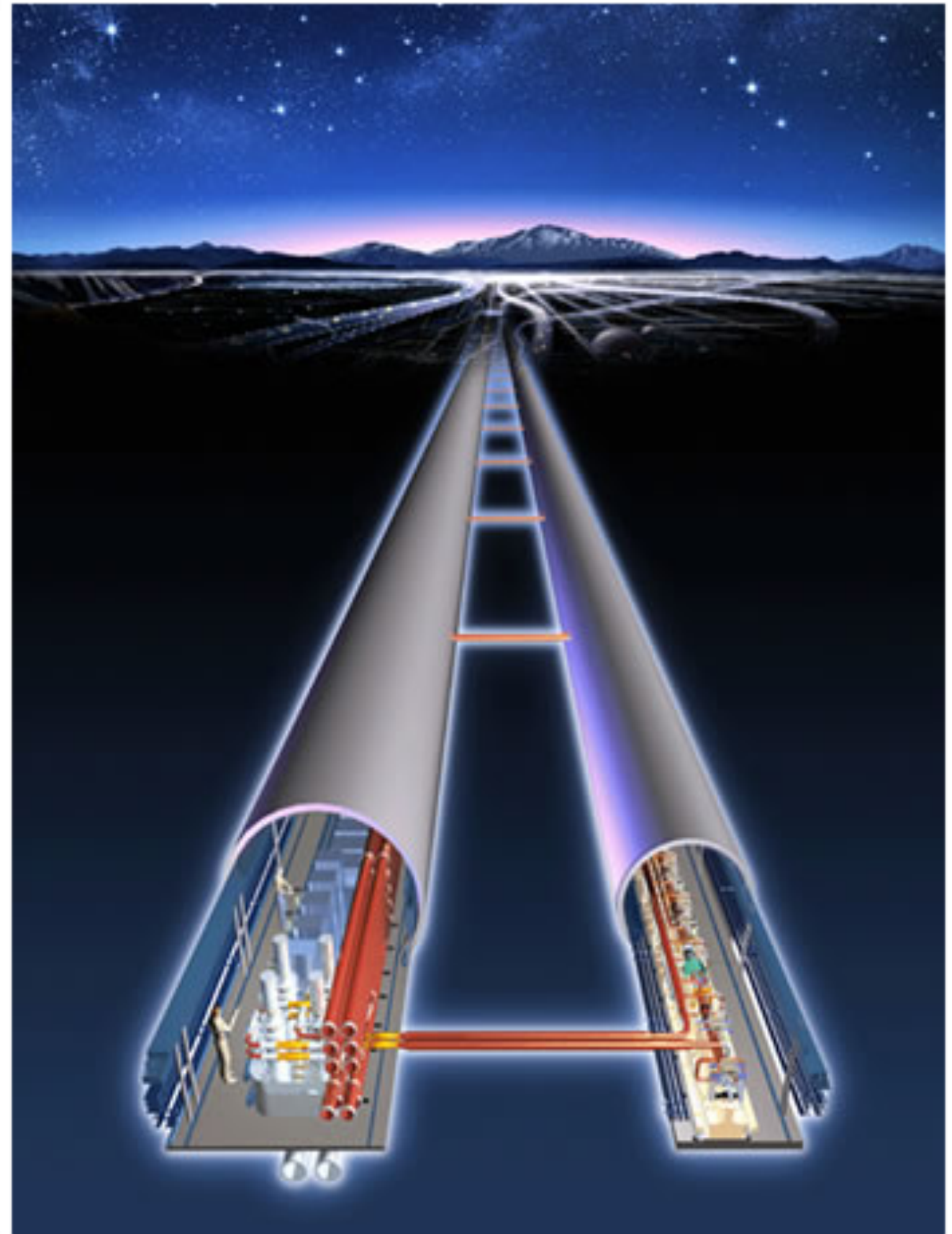

Online meeting, 18.9.20

ILC UK

Theory view

Veronica Sanz (Sussex & Valencia)



Online meeting, 18.9.20

ILC UK

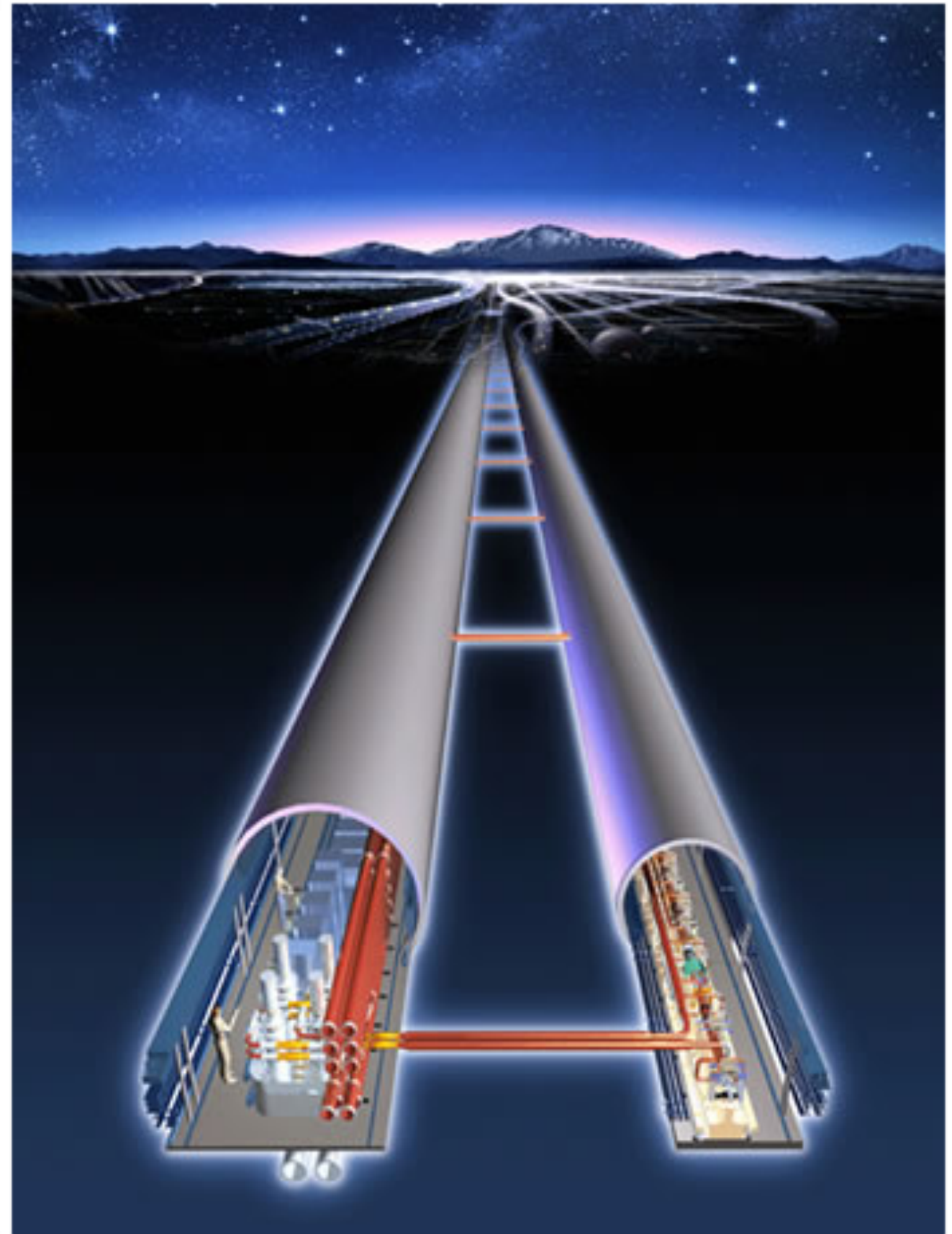
My **Theory view**

Veronica Sanz (Sussex & Valencia)

maybe representative

Discovery of new phenomena

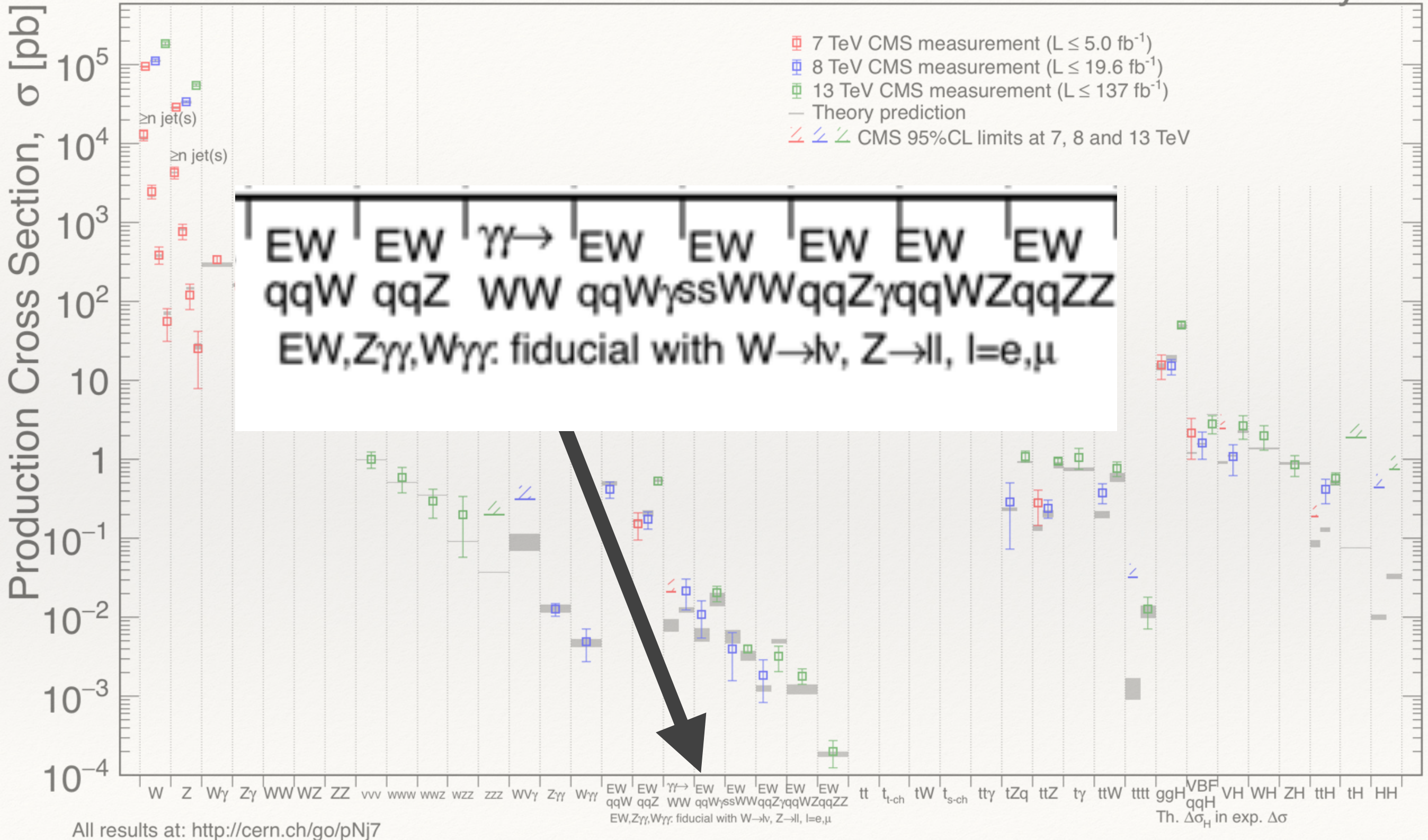
Not particularly invested in
future colliders



Testing the Standard Model

May 2020

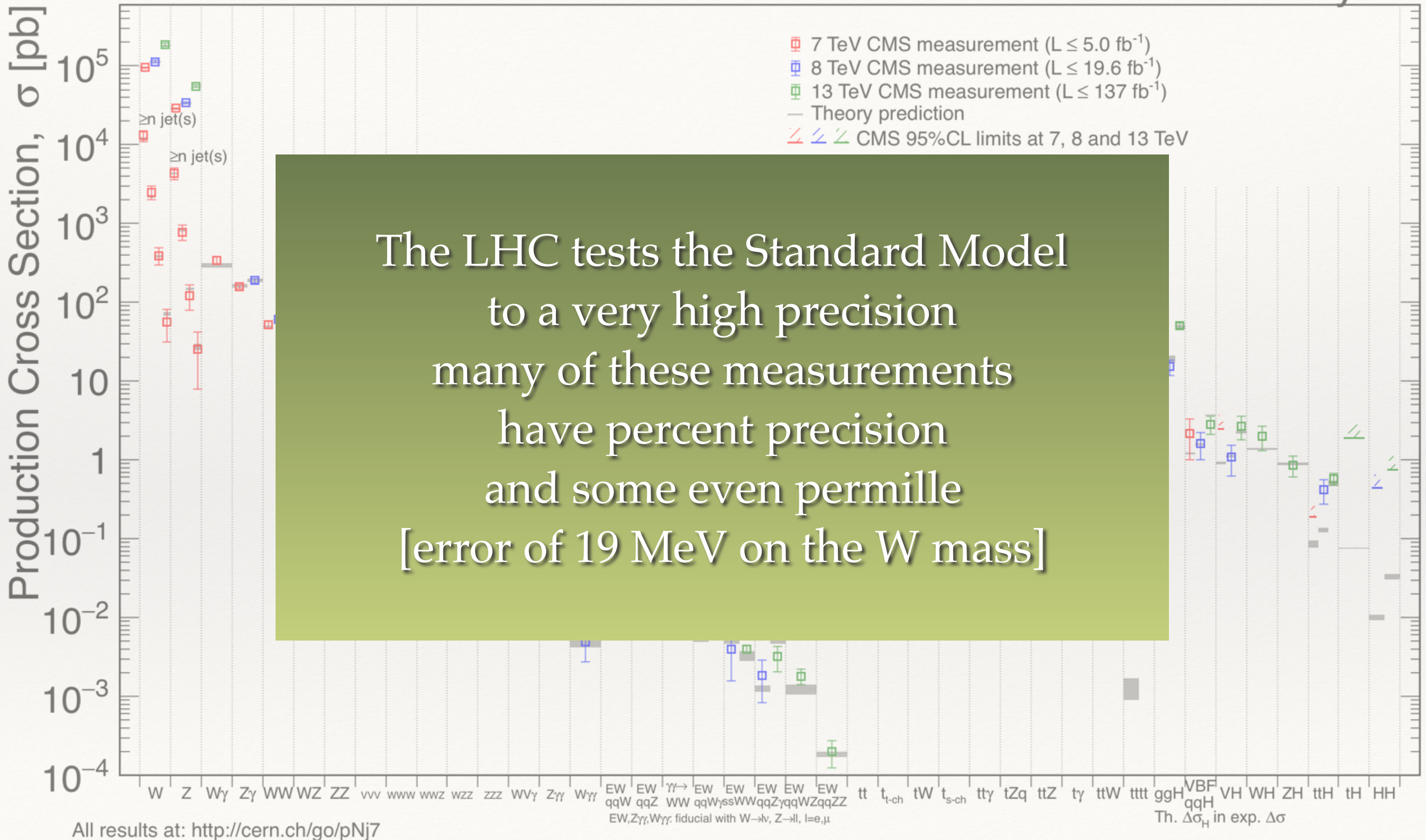
CMS Preliminary



Testing the Standard Model

May 2020

CMS Preliminary



Celebrating the Standard Model

Those are *impressive* achievements

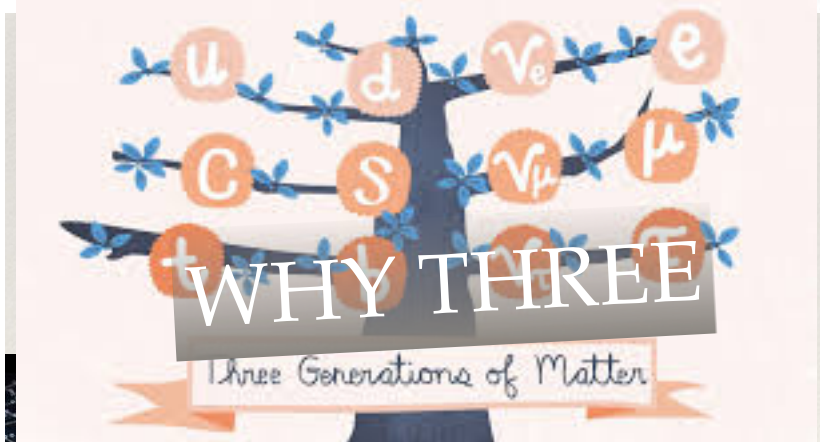
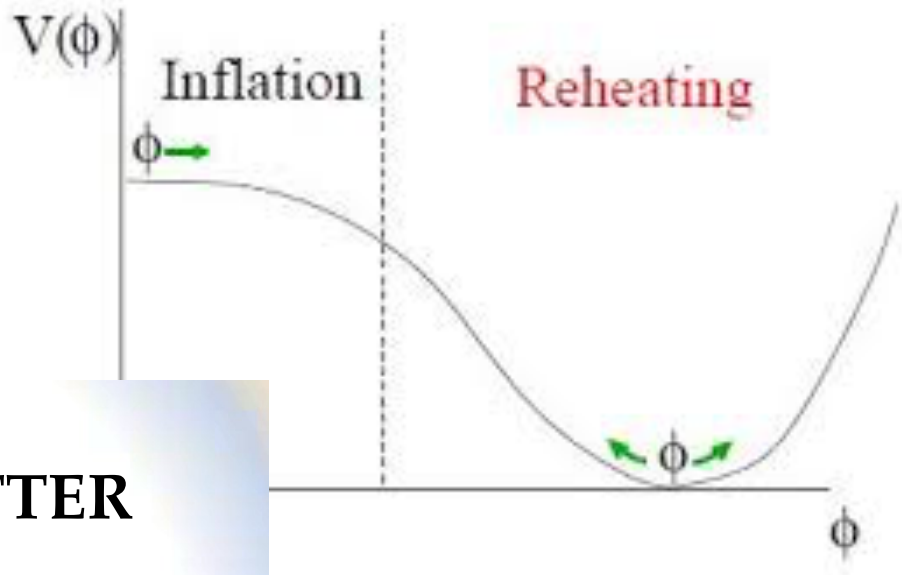
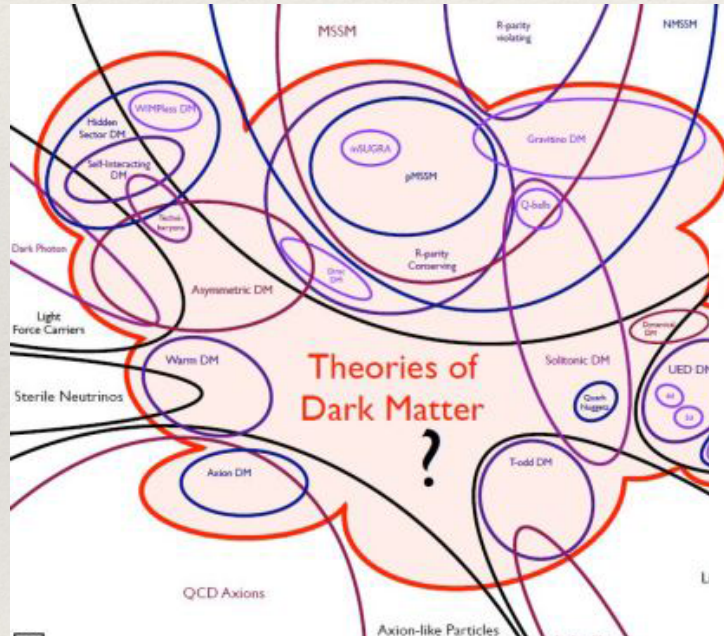
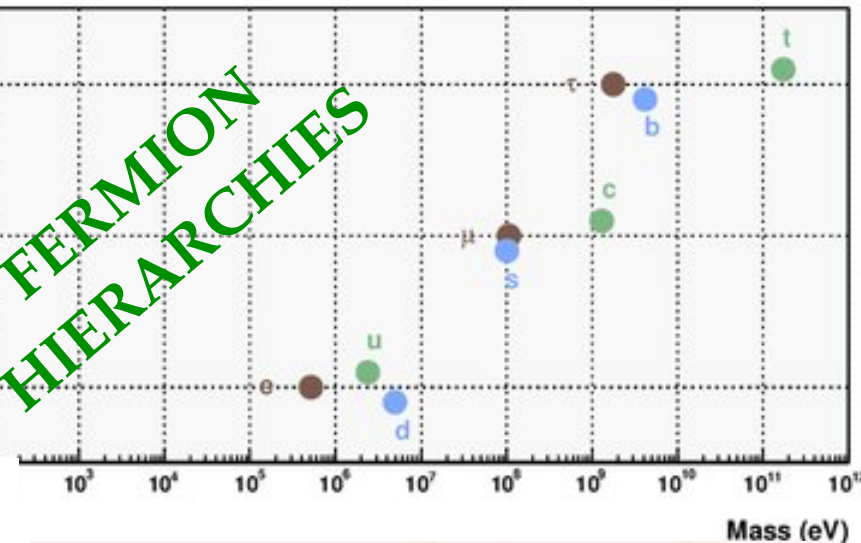
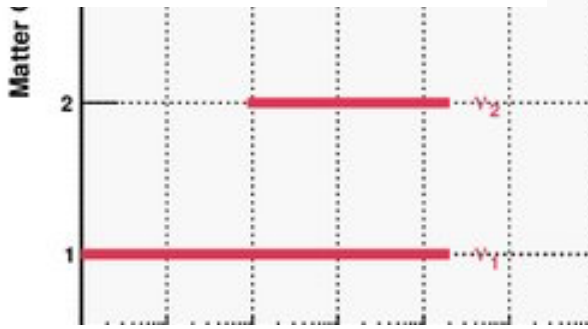
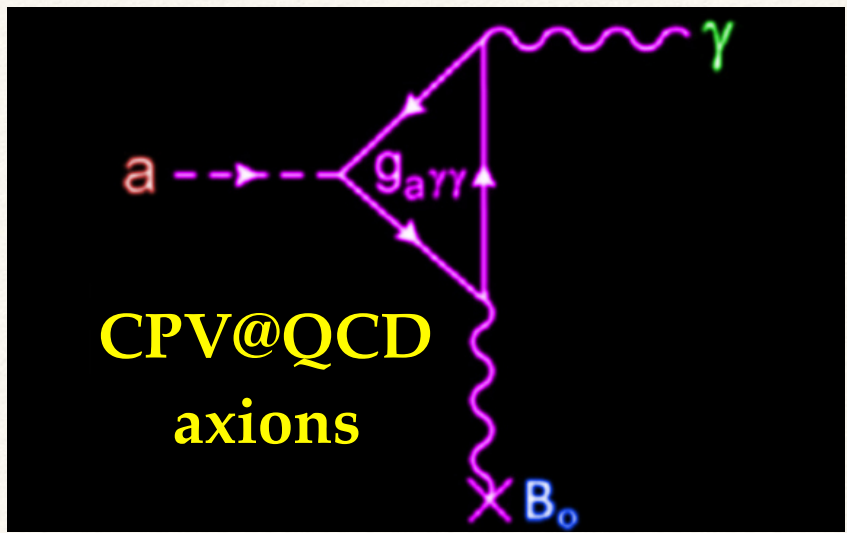
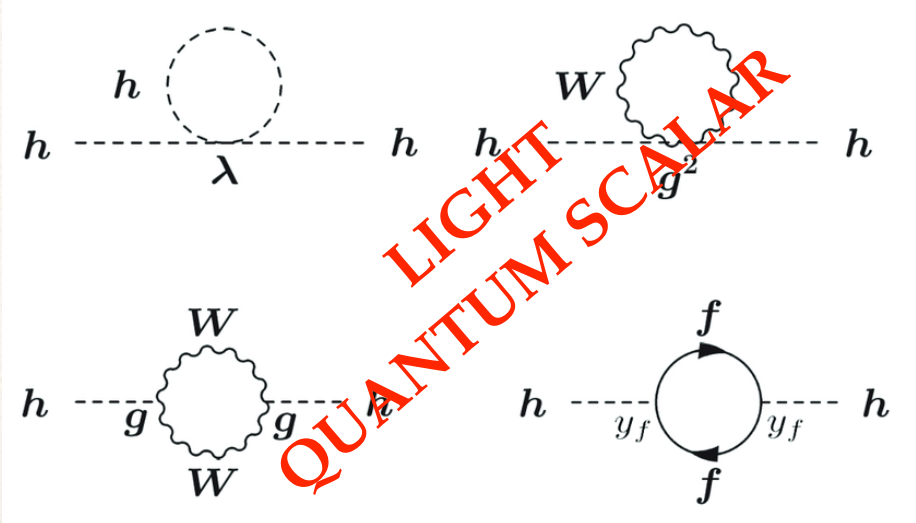
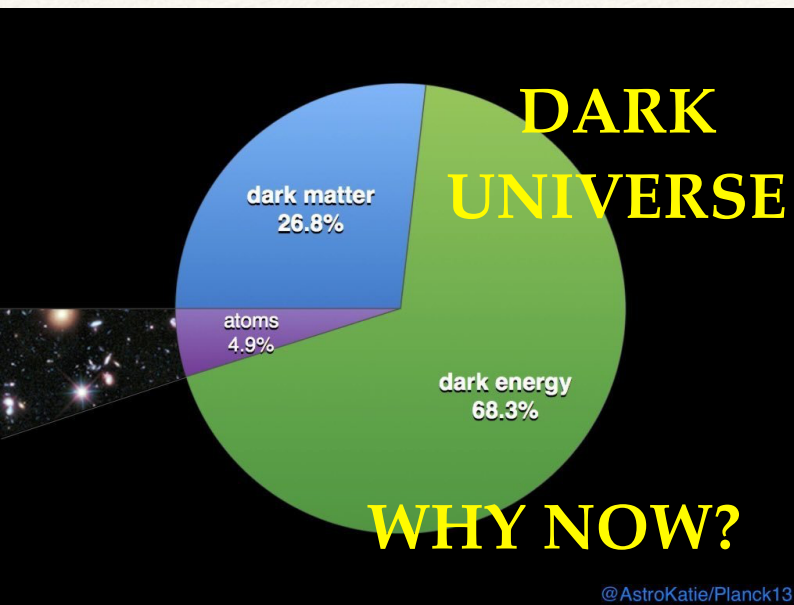
a single theory, developed long time ago
based on rather simple building blocks

can predict Nature's behaviour at high energy
with unparalleled precision
in many kinematic situations
involving numerous different particles

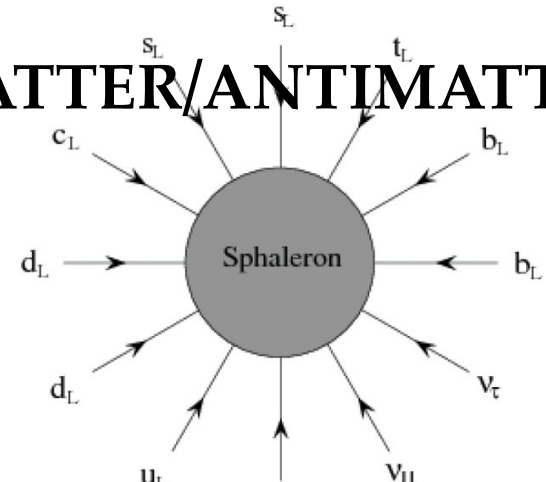
So why aren't we just *happy*?

why do we keep searching? why such a huge international
investment on Particle Physics and colliders?

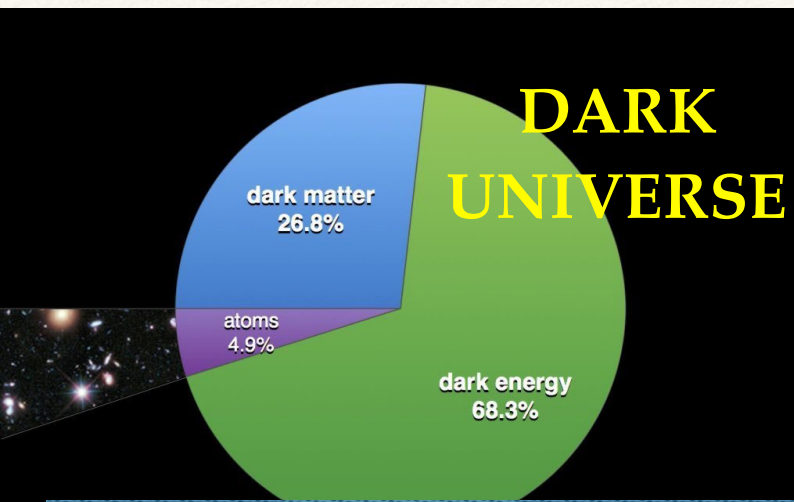
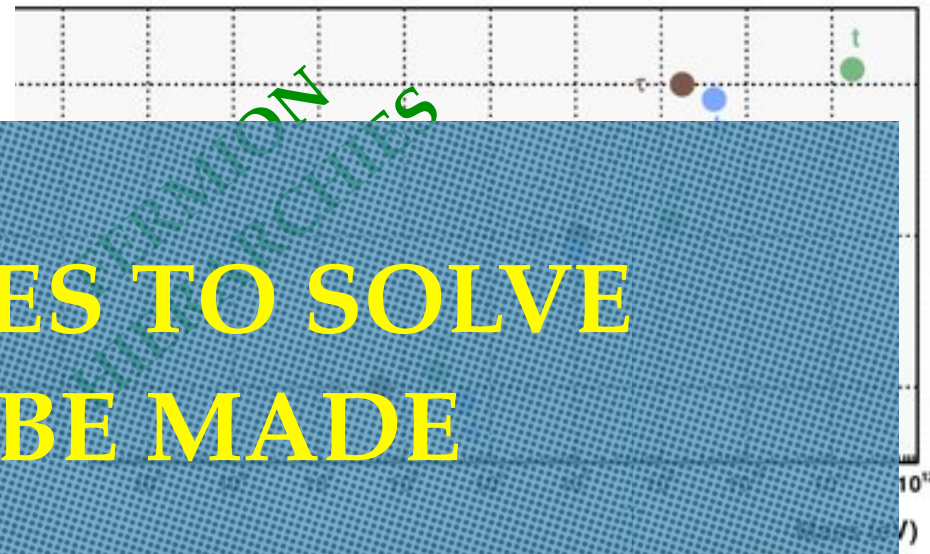
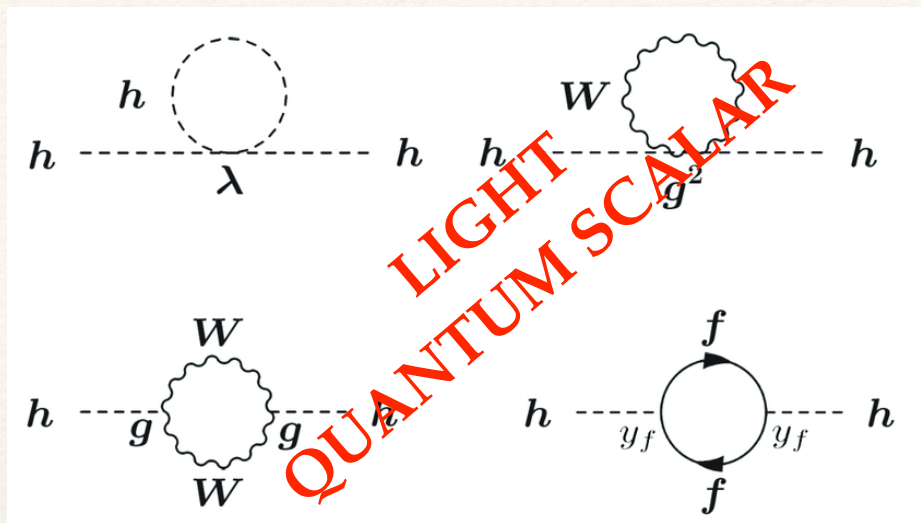
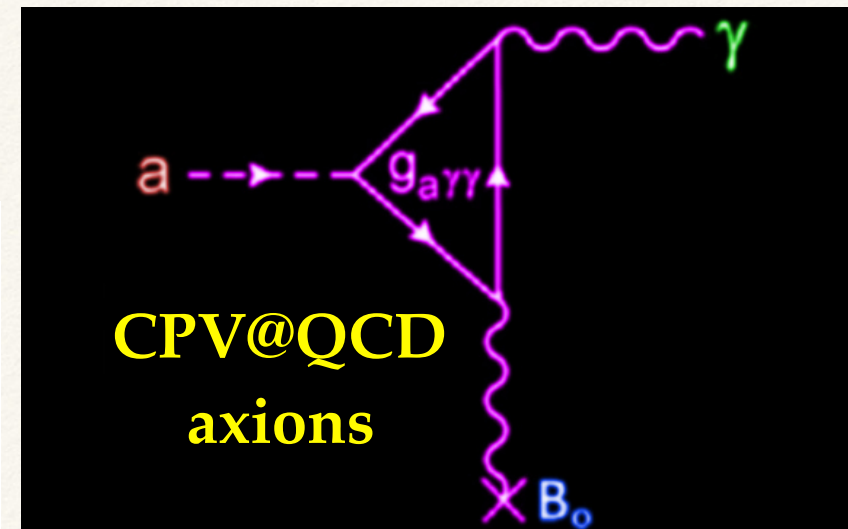
Because that can't be it



MATTER/ANTIMATTER



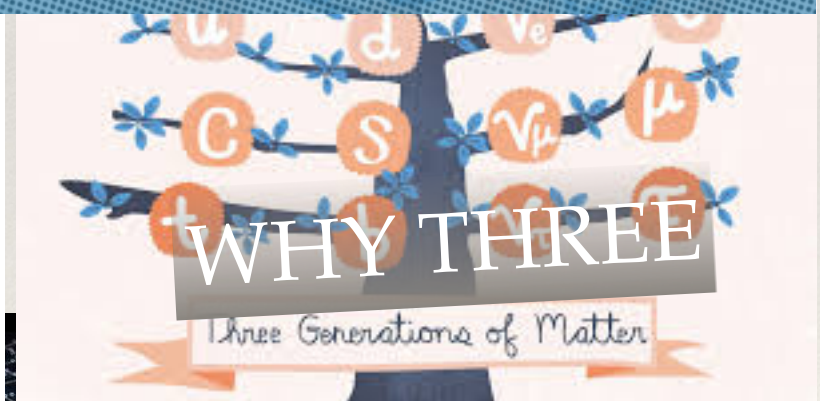
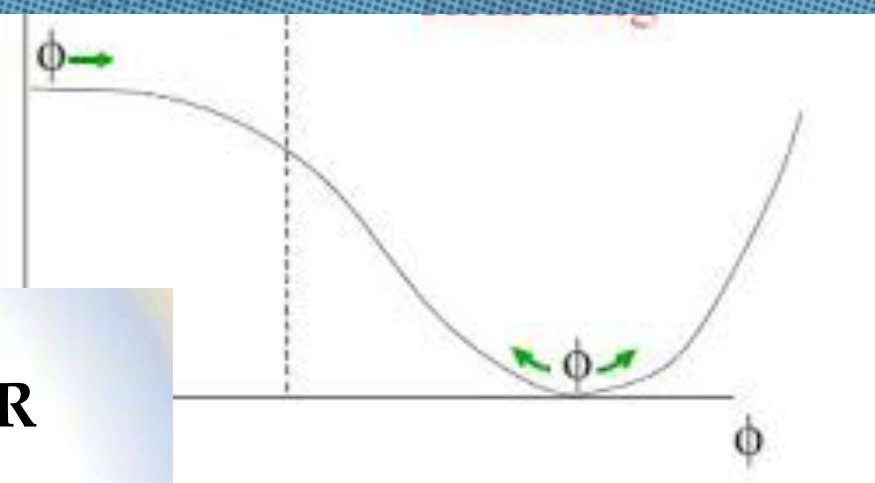
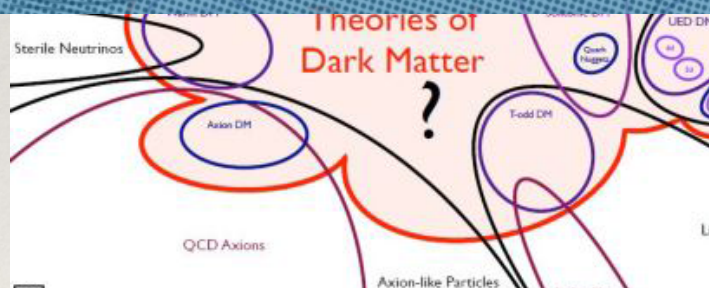
Because that can't be it



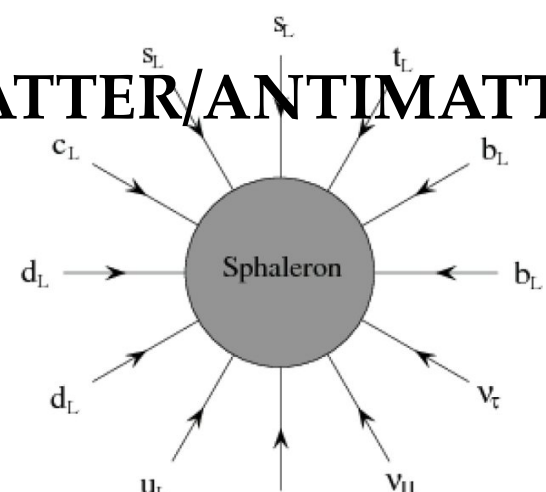
WHY NOW?

THERE ARE MANY MYSTERIES TO SOLVE

MANY DISCOVERIES TO BE MADE



MATTER/ANTIMATTER



ILC physics case

Initial paper in 2015 + follow-ups

Although there is some potential for **direct** detection of light/hidden particles most of its focus is on **precision** measurements **indirect** searches for new phenomena

If **precision** is the name of the game difficult not to compare with **circular** lepton colliders

FCC-ee

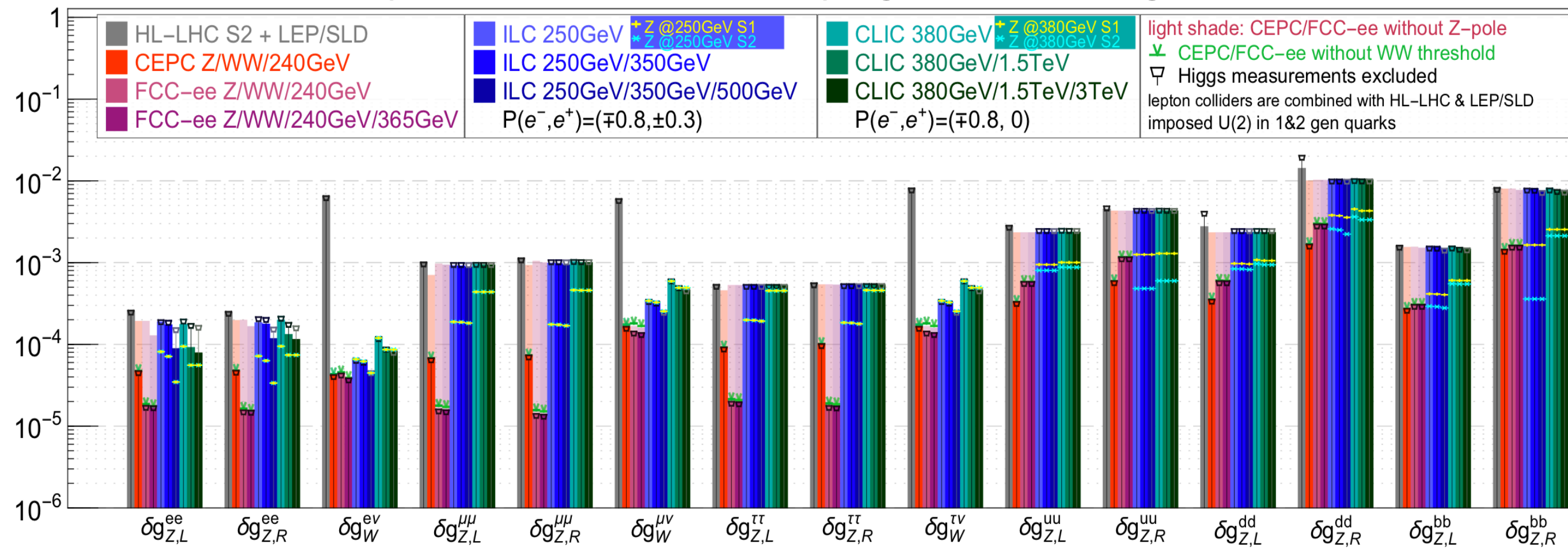
More stats \longrightarrow more precision

Example stats- \rightarrow precision

Let's compare what lepton colliders could do in terms of precision measurements of couplings

Just an example, but characteristic

precision reach on EW couplings from full EFT global fit [de Blas et al](#)



So if precision were the only parameter: *circular*

Even as a theorist, I do understand that
building a collider
is not an *academic exercise*
it is a decades-long effort
drives a whole scientific field
and where risks (e.g. technology) are taken

Let's discuss some of the advantages of ILC
from a theorist perspective

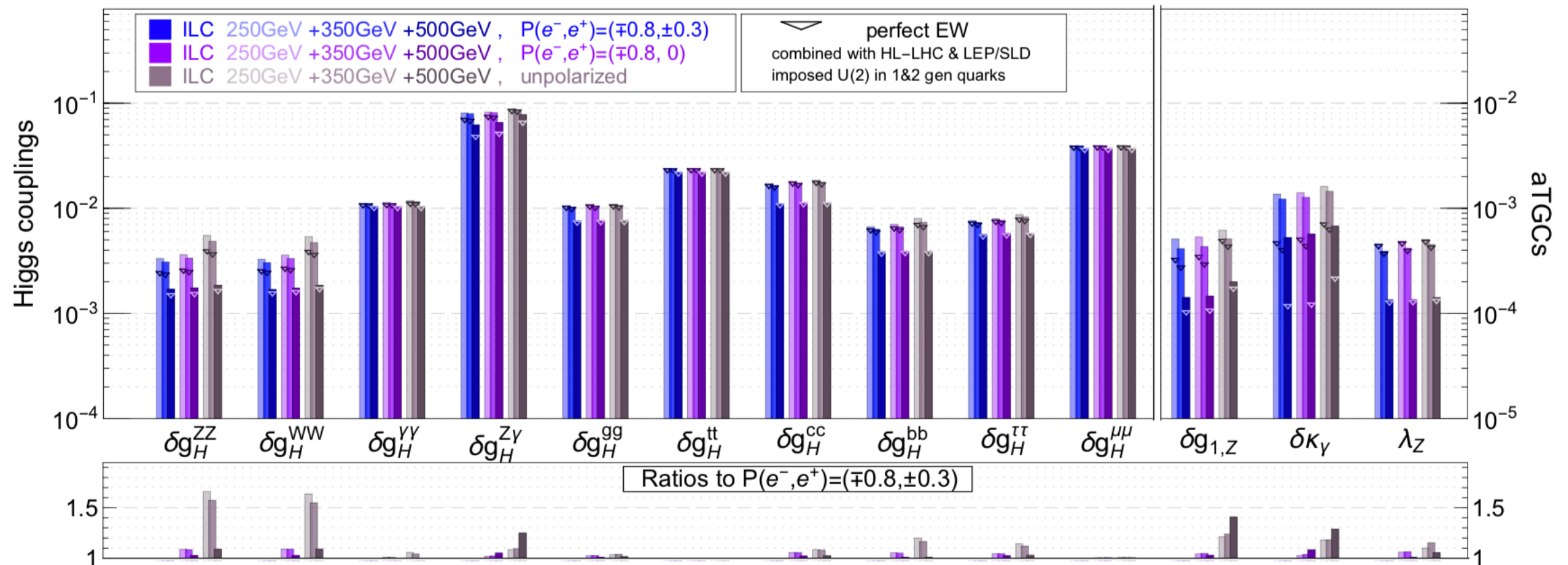
Polarisation

ILC polarisation capabilities allows exploring new physics which distinguishes L/R

Important for fermion contact interactions and for the Higgs to Z-Gamma coupling

In a global search for new physics (like an EFT analysis) polarisation breaks degeneracies

precision reach on effective couplings from full EFT global fit [de Blas et al](#)



Feasibility/timing

From an outsider perspective the ILC project seems very advanced 2km prototype, no showstoppers

If there were political will construction could start now first results in a few years

	T ₀		+5		+10		+15		+20		...	+26
ILC	0.5/ab 250 GeV			1.5/ab 250 GeV			1.0/ab 500 GeV	0.2/ab 2m _{top}	3/ab 500 GeV			
CEPC	5.6/ab 240 GeV			16/ab M _Z	2.6 /ab 2M _W					SppC =>		
CLIC	1.0/ab 380 GeV					2.5/ab 1.5 TeV			5.0/ab => until +28 3.0 TeV			
FCC	150/ab ee, M _Z	10/ab ee, 2M _W	5/ab ee, 240 GeV			1.7/ab ee, 2m _{top}			hh.eh =>			
LHeC	0.06/ab			0.2/ab			0.72/ab					
HE-LHC	10/ab per experiment in 20y											
FCC eh/hh	20/ab per experiment in 25y											

The sequence HL-LHC —> FCC implies a **long gap** in Particle Physics the area, with no big collider experiment driving the field, may not survive and with it, all the training and other spin-offs we generate

Summary

From the LHC we have **no guidance** on where to look for new phenomena, no energy range and no level of precision

7->8->13 TeV potential for new **direct** discoveries
seems exhausted

HL-LHC will probe further into the precision frontier

EFT interpretation will become the new SM, **indirect** searches

Precision-way (with lepton colliders) may seem like a *safer* bet
than exploring higher energies

As a theorist, looks like **now** is a critical moment to decide the
future of the field as a whole

Best way forward may be to ensure **continuity** in the field
and for that the ILC's advanced design stage is a clear advantage