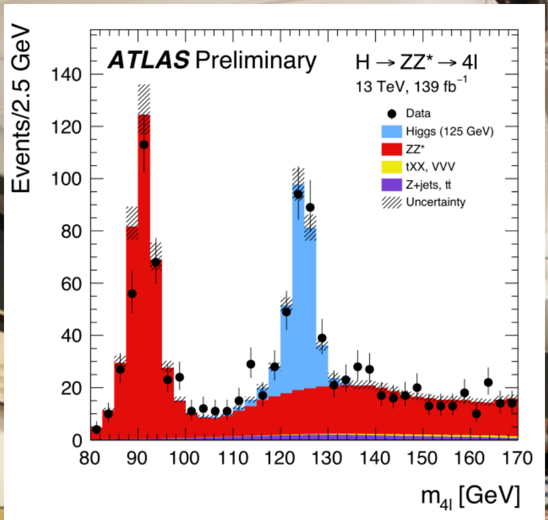
International Partners, focus on CERN-TH

July 3rd
JGU Mainz

Matthew McCullough

Fourteen years since a landmark discovery in Particle Physics: Discovery of the Higgs Boson.



A History of German Theory Leadership

Higgs

- Era-defining publications on Higgs phenomenology at the LHC.
- Early and continued stewardship of experimental program, e.g. through LHC Higgs Cross Section Working Group.

Precision EW

- Key calculations to enable the LEP precision program.
- Leading role in interpretation of precision measurements to explore physics beyond the Standard Model.

Flavour

- A legacy of critical contributions in precision calculations and in defining the flavour programme at LHC and dedicated flavour experiments.

Also leading roles in other fields, such as lattice, astroparticle, etc.

A History of German Theory Leadership

Higgs

- E... on Higgs phenomenology at the LHC.
- E... experimental program, e.g. t...

- ...
- Lea... explore phys...

These fields are core components of the FCC-ee physics programme. German theory community is best placed to carry the legacy of successes from LEP and LHC era into the future!

Flavour

- A legacy of critical contributions in precision calc... ...d in defining the flavour programme at LHC and dedicated flav...ur experiments.

Also leading roles in other fields, such as lattice, astroparticle, etc.

The World as We've Known It

1 H																		2 He
3 Li	4 Be												5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg												13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca		21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr		39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	*	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	**	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
		*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb		
		**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	Wikipedia	

The World as We've Known It

LIGHT UNFLAVORED ($S = C = B = 0$)	$I^G(J^{PC})$
• $\pi^\pm$	$1^-(0^-)$
• π^0	$1^-(0^{-+})$
• η	$0^+(0^{-+})$
• $f_0(500)$	$0^+(0^{++})$
• $\rho(770)$	$1^+(1^{--})$
• $\omega(782)$	$0^-(1^{--})$
• $\eta'(958)$	$0^+(0^{-+})$
• $f_0(980)$	$0^+(0^{++})$
• $a_0(980)$	$1^-(0^{++})$
• $\phi(1020)$	$0^-(1^{--})$
• $h_1(1170)$	$0^-(1^{+-})$
• $b_1(1235)$	$1^+(1^{+-})$
• $a_1(1260)$	$1^-(1^{++})$
• $f_2(1270)$	$0^+(2^{++})$
• $f_1(1285)$	$0^+(1^{++})$
• $\eta(1295)$	$0^+(0^{-+})$
• $\pi(1300)$	$1^-(0^{-+})$
• $a_2(1320)$	$1^-(2^{++})$
• $f_0(1370)$	$0^+(0^{++})$
$h_1(1380)$	$?^-(1^{+-})$
• $\pi_1(1400)$	$1^-(1^{-+})$
• $\eta(1405)$	$0^+(0^{-+})$
• $f_1(1420)$	$0^+(1^{++})$
• $\omega(1420)$	$0^-(1^{--})$
$f_2(1430)$	$0^+(2^{++})$
• $a_0(1450)$	$1^-(0^{++})$
• $\rho(1450)$	$1^+(1^{--})$
• $\eta(1475)$	$0^+(0^{-+})$
• $f_0(1500)$	$0^+(0^{++})$
$f_1(1510)$	$0^+(1^{++})$
• $f_2'(1525)$	$0^+(2^{++})$
$f_2(1565)$	$0^+(2^{++})$
$\rho(1570)$	$1^+(1^{--})$
$h_1(1595)$	$0^-(1^{+-})$
• $\pi_1(1600)$	$1^-(1^{-+})$
$a_1(1640)$	$1^-(1^{++})$
$f_2(1640)$	$0^+(2^{++})$
• $\eta_2(1645)$	$0^+(2^{-+})$
• $\omega(1650)$	$0^-(1^{--})$
• $\omega_3(1670)$	$0^-(3^{--})$
• $\pi_2(1670)$	$1^-(2^{-+})$
• $\phi(1680)$	$0^-(1^{--})$
• $\rho_3(1690)$	$1^+(3^{--})$
• $\rho(1700)$	$1^+(1^{--})$
$a_2(1700)$	$1^-(2^{++})$
• $f_0(1710)$	$0^+(0^{++})$
$\eta(1760)$	$0^+(0^{-+})$
• $\pi(1800)$	$1^-(0^{-+})$
$f_2(1810)$	$0^+(2^{++})$
$X(1835)$	$?^?(?^{-+})$
$X(1840)$	$?^?(?^{??})$
• $\phi_3(1850)$	$0^-(3^{--})$
$\eta_2(1870)$	$0^+(2^{-+})$
• $\pi_2(1880)$	$1^-(2^{-+})$
$\rho(1900)$	$1^+(1^{--})$
$f_2(1910)$	$0^+(2^{++})$
• $f_2(1950)$	$0^+(2^{++})$
$\rho_3(1990)$	$1^+(3^{--})$
• $f_2(2010)$	$0^+(2^{++})$
$f_0(2020)$	$0^+(0^{++})$
• $a_4(2040)$	$1^-(4^{++})$
• $f_4(2050)$	$0^+(4^{++})$
$\pi_2(2100)$	$1^-(2^{-+})$
$f_0(2100)$	$0^+(0^{++})$
$f_2(2150)$	$0^+(2^{++})$
$\rho(2150)$	$1^+(1^{--})$
• $\phi(2170)$	$0^-(1^{--})$
$f_0(2200)$	$0^+(0^{++})$
$f_J(2220)$	$0^+(2^{++}$ or $4^{++})$
$\eta(2225)$	$0^+(0^{-+})$
$\rho_3(2250)$	$1^+(3^{--})$
• $f_2(2300)$	$0^+(2^{++})$
$f_4(2300)$	$0^+(4^{++})$
$f_0(2330)$	$0^+(0^{++})$
• $f_2(2340)$	$0^+(2^{++})$
$\rho_5(2350)$	$1^+(5^{--})$
$a_6(2450)$	$1^-(6^{++})$
$f_6(2510)$	$0^+(6^{++})$

OTHER LIGHT
Further States

STRANGE ($S = \pm1$, $C = B = 0$)	$I(J^P)$
• $K^\pm$	$1/2(0^-)$
• K^0	$1/2(0^-)$
• K^0_S	$1/2(0^-)$
• K^0_L	$1/2(0^-)$
$K_0^*(800)$	$1/2(0^+)$
• $K^*(892)$	$1/2(1^-)$
• $K_1(1270)$	$1/2(1^+)$
• $K_1(1400)$	$1/2(1^+)$
• $K^*(1410)$	$1/2(1^-)$
• $K_0^*(1430)$	$1/2(0^+)$
• $K_2^*(1430)$	$1/2(2^+)$
$K(1460)$	$1/2(0^-)$
$K_2(1580)$	$1/2(2^-)$
$K(1630)$	$1/2(?^?)$
$K_1(1650)$	$1/2(1^+)$
• $K^*(1680)$	$1/2(1^-)$
• $K_2(1770)$	$1/2(2^-)$
• $K_3^*(1780)$	$1/2(3^-)$
• $K_2(1820)$	$1/2(2^-)$
$K(1830)$	$1/2(0^-)$
$K_0^*(1950)$	$1/2(0^+)$
$K_2^*(1980)$	$1/2(2^+)$
• $K_4^*(2045)$	$1/2(4^+)$
$K_2(2250)$	$1/2(2^-)$
$K_3(2320)$	$1/2(3^+)$
$K_5^*(2380)$	$1/2(5^-)$
$K_4(2500)$	$1/2(4^-)$
$K(3100)$	$?^?(?^{??})$

CHARMED ($C = \pm1$)	
• $D^\pm$	$1/2(0^-)$
• D^0	$1/2(0^-)$
• $D^*(2007)^0$	$1/2(1^-)$
• $D^*(2010)^\pm$	$1/2(1^-)$
• $D_0^*(2400)^0$	$1/2(0^+)$
$D_0^*(2400)^\pm$	$1/2(0^+)$
• $D_1(2420)^0$	$1/2(1^+)$
$D_1(2420)^\pm$	$1/2(?^?)$
$D_1(2430)^0$	$1/2(1^+)$
• $D_2^*(2460)^0$	$1/2(2^+)$
• $D_2^*(2460)^\pm$	$1/2(2^+)$
$D(2550)^0$	$1/2(0^-)$
$D(2600)$	$1/2(?^?)$
$D^*(2640)^\pm$	$1/2(?^?)$
$D(2750)$	$1/2(?^?)$

CHARMED, STRANGE ($C = S = \pm1$)	$I(J^P)$
• $D_s^\pm$	$0(0^-)$
• $D_s^{*\pm}$	$0(?^?)$
• $D_{s0}^*(2317)^\pm$	$0(0^+)$
• $D_{s1}(2460)^\pm$	$0(1^+)$
• $D_{s1}(2536)^\pm$	$0(1^+)$
• $D_{s2}(2573)$	$0(?^?)$
• $D_{s1}^*(2700)^\pm$	$0(1^-)$
$D_{sJ}^*(2860)^\pm$	$0(?^?)$
$D_{sJ}(3040)^\pm$	$0(?^?)$

BOTTOM ($B = \pm1$)	
• $B^\pm$	$1/2(0^-)$
• B^0	$1/2(0^-)$
• $B^\pm/B^0$ ADMIXTURE	
• $B^\pm/B^0/B^0_s$/b-baryon ADMIXTURE	
V_{cb} and V_{ub} CKM Matrix Elements	
• B^*	$1/2(1^-)$
$B_J^*(5732)$	$?(?^?)$
• $B_1(5721)^0$	$1/2(1^+)$
• $B_2^*(5747)^0$	$1/2(2^+)$

BOTTOM, STRANGE ($B = \pm1$, $S = \mp1$)	
• B^0_s	$0(0^-)$
• B^*_s	$0(1^-)$
• $B_{s1}(5830)^0$	$0(1^+)$
• $B_{s2}^*(5840)^0$	$0(2^+)$
$B_{sJ}^*(5850)$	$?(?^?)$

BOTTOM, CHARMED ($B = C = \pm1$)	
• $B_c^\pm$	$0(0^-)$

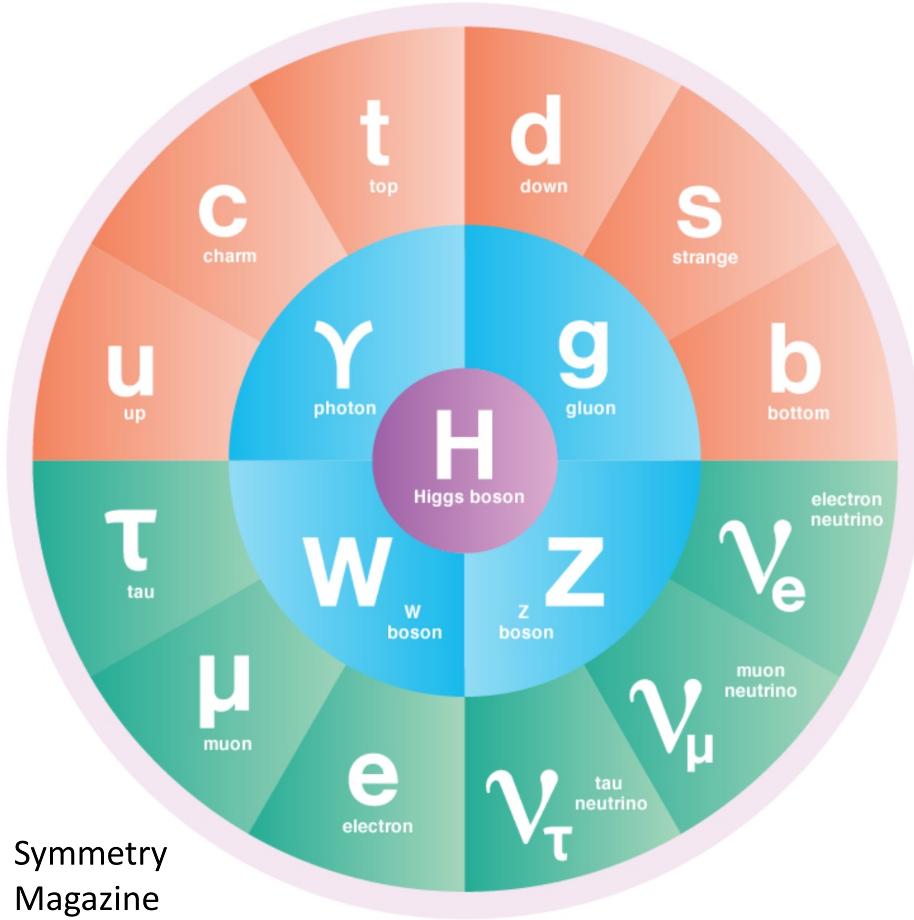
$c\bar{c}$	$I^G(J^{PC})$
• $\eta_c(1S)$	$0^+(0^{-+})$
• $J/\psi(1S)$	$0^-(1^{--})$
• $\chi_{c0}(1P)$	$0^+(0^{++})$
• $\chi_{c1}(1P)$	$0^+(1^{++})$
• $h_c(1P)$	$?^?(1^{+-})$
• $\chi_{c2}(1P)$	$0^+(2^{++})$
• $\eta_c(2S)$	$0^+(0^{-+})$
• $\psi(2S)$	$0^-(1^{--})$
• $\psi(3770)$	$0^-(1^{--})$
$X(3823)$	$?^?(?^{?-})$
• $X(3872)$	$0^+(1^{++})$
• $X(3900)^\pm$	$?(1^+)$
$X(3900)^0$	$?(?^?)$
• $\chi_{c0}(2P)$	$0^+(0^{++})$
• $\chi_{c2}(2P)$	$0^+(2^{++})$
$X(3940)$	$?^?(?^{??})$
$X(4020)^\pm$	$?(?^?)$
• $\psi(4040)$	$0^-(1^{--})$
$X(4050)^\pm$	$?(?^?)$
$X(4140)$	$0^+(?^{?+})$
• $\psi(4160)$	$0^-(1^{--})$
$X(4160)$	$?^?(?^{??})$
$X(4250)^\pm$	$?(?^?)$
• $X(4260)$	$?^?(1^{--})$
$X(4350)$	$0^+(?^{?+})$
• $X(4360)$	$?^?(1^{--})$
• $\psi(4415)$	$0^-(1^{--})$
$X(4430)^\pm$	$?(1^+)$
• $X(4660)$	$?^?(1^{--})$

$b\bar{b}$	
$\eta_b(1S)$	$0^+(0^{-+})$
• $\Upsilon(1S)$	$0^-(1^{--})$
• $\chi_{b0}(1P)$	$0^+(0^{++})$
• $\chi_{b1}(1P)$	$0^+(1^{++})$
• $h_b(1P)$	$?^?(1^{+-})$
• $\chi_{b2}(1P)$	$0^+(2^{++})$
$\eta_b(2S)$	$0^+(0^{-+})$
• $\Upsilon(2S)$	$0^-(1^{--})$
• $\Upsilon(1D)$	$0^-(2^{--})$
• $\chi_{b0}(2P)$	$0^+(0^{++})$
• $\chi_{b1}(2P)$	$0^+(1^{++})$
$h_b(2P)$	$?^?(1^{+-})$
• $\chi_{b2}(2P)$	$0^+(2^{++})$
• $\Upsilon(3S)$	$0^-(1^{--})$
• $\chi_b(3P)$	$?^?(?^{?+})$
• $\Upsilon(4S)$	$0^-(1^{--})$
$X(10610)^\pm$	$1^+(1^+)$
$X(10610)^0$	$1^+(1^+)$
$X(10650)^\pm$	$?^+(1^+)$
• $\Upsilon(10860)$	$0^-(1^{--})$
• $\Upsilon(11020)$	$0^-(1^{--})$

PDG

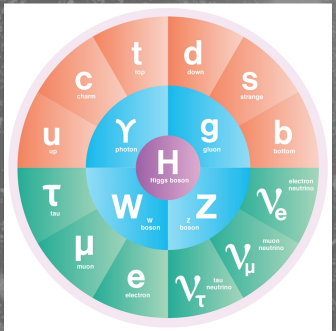
Plus photon, electron, muon etc...

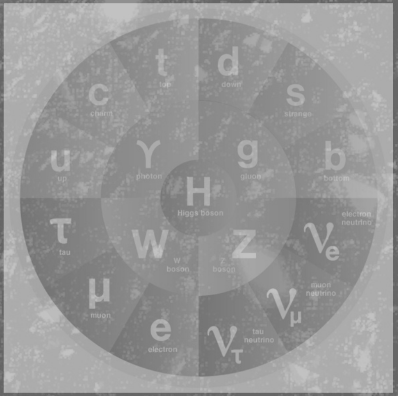
The World as We've Known It



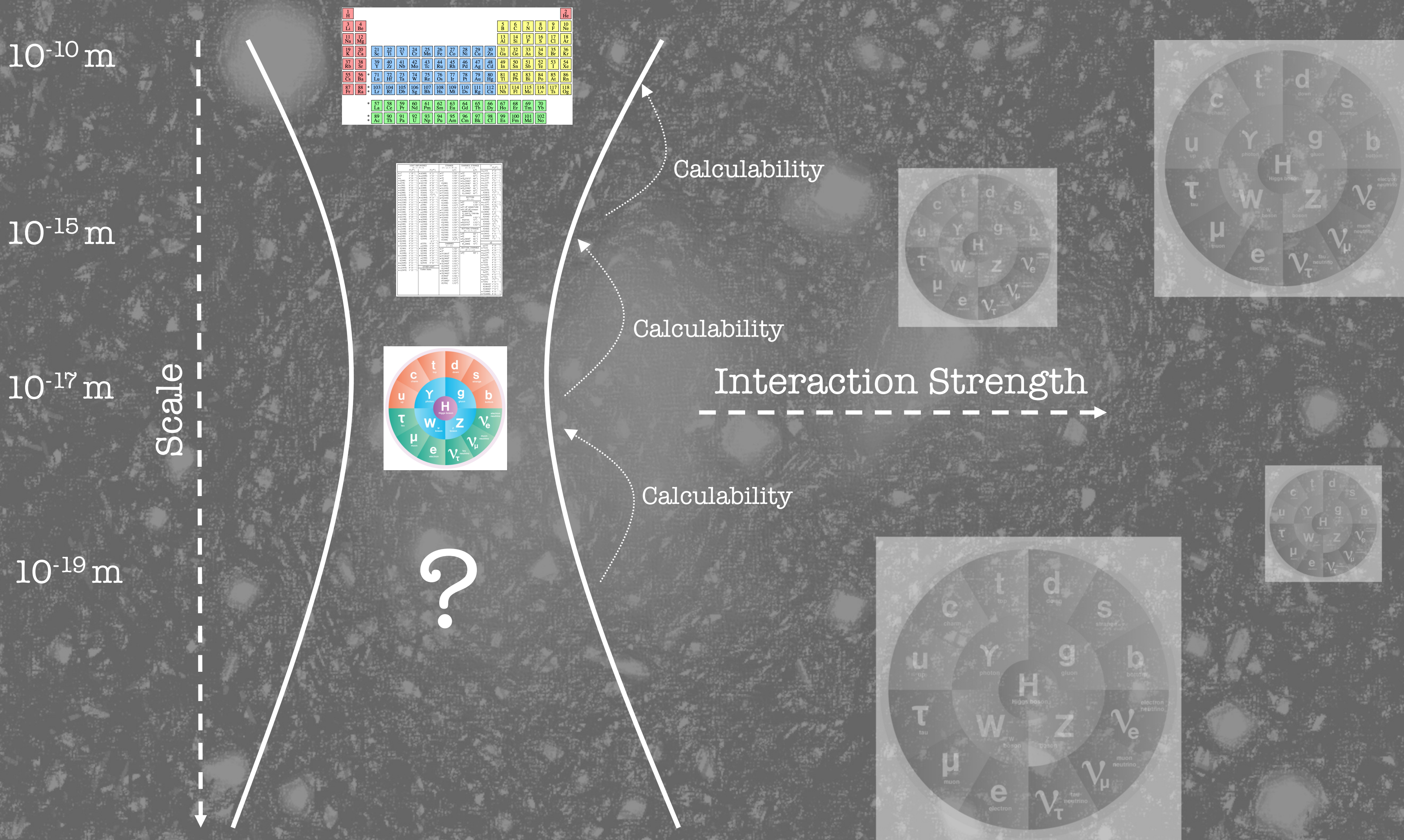
Symmetry
Magazine

Our World as We've Known It





The Lessons We've Learned



Next Steps

European Strategy process recently concluded.

European Strategy
for Particle Physics

The European Strategy for Particle Physics:
2026 Update

Recommendations

by the European Strategy Group

3. The next CERN flagship collider project

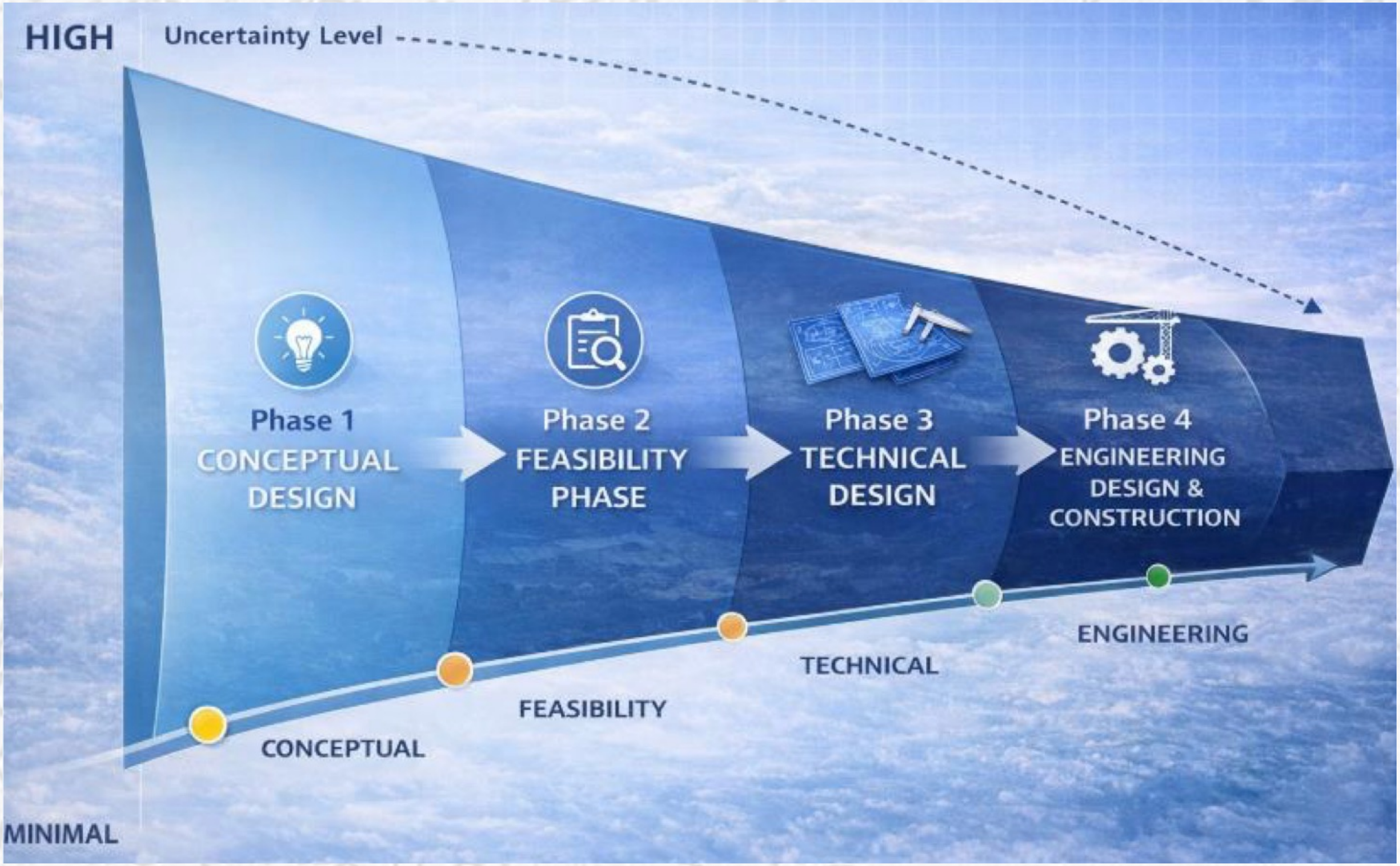
A. The electron–positron Future Circular Collider (FCC-ee) is recommended as the preferred option for the next flagship collider at CERN.

The FCC-ee would deliver the world's broadest high-precision particle physics programme, with an outstanding discovery potential through the Higgs, electroweak, flavour and top-quark sectors, as well as advances in quantum chromodynamics (QCD). Its technical feasibility is demonstrated by the comprehensive FCC Feasibility Study, its scope and cost are well defined, plausible funding scenarios have been developed and its schedule enables first beams within five to seven years after the end of HL-LHC operations. The FCC-ee would maintain European leadership in high-energy particle physics, as well as advancing technology and providing significant societal benefits.

The FCC-ee would also pave the way towards a hadron collider reusing the tunnel and much of the infrastructure, providing direct discovery reach well beyond the 10 TeV parton energy scale, in line with the community's ambition for exploration at the highest achievable energy. The overwhelming endorsement of the FCC-ee by the particle physics communities of CERN's Member and Associate Member States further reinforces it as the preferred path.

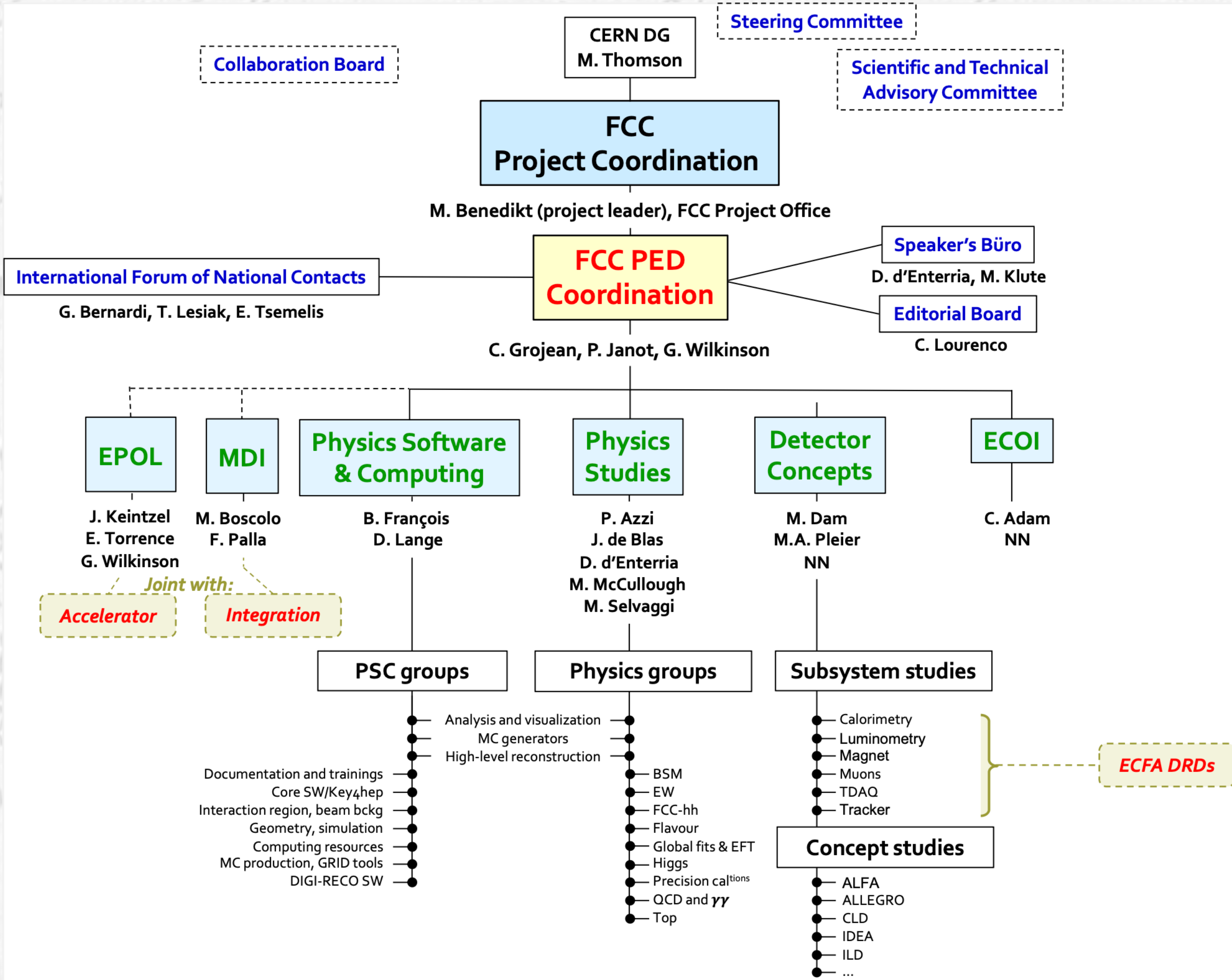
Future Circular Collider (FCC-ee) emerged as preferred option for next flagship collider.

Next Steps



2026-2028 Reference Design Phase
2029-2032 Technical Design Phase

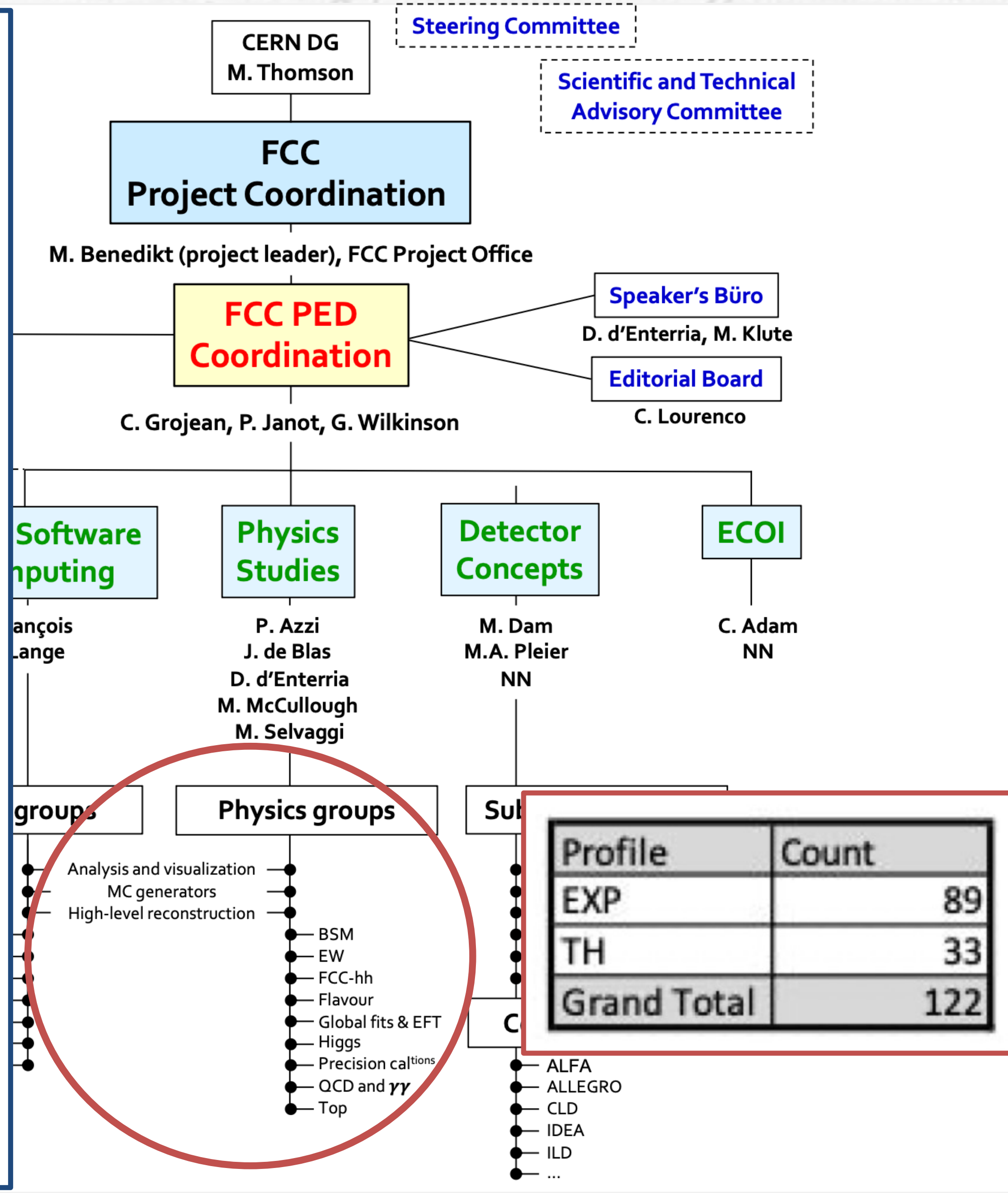
FCC Structure



FCC Structure

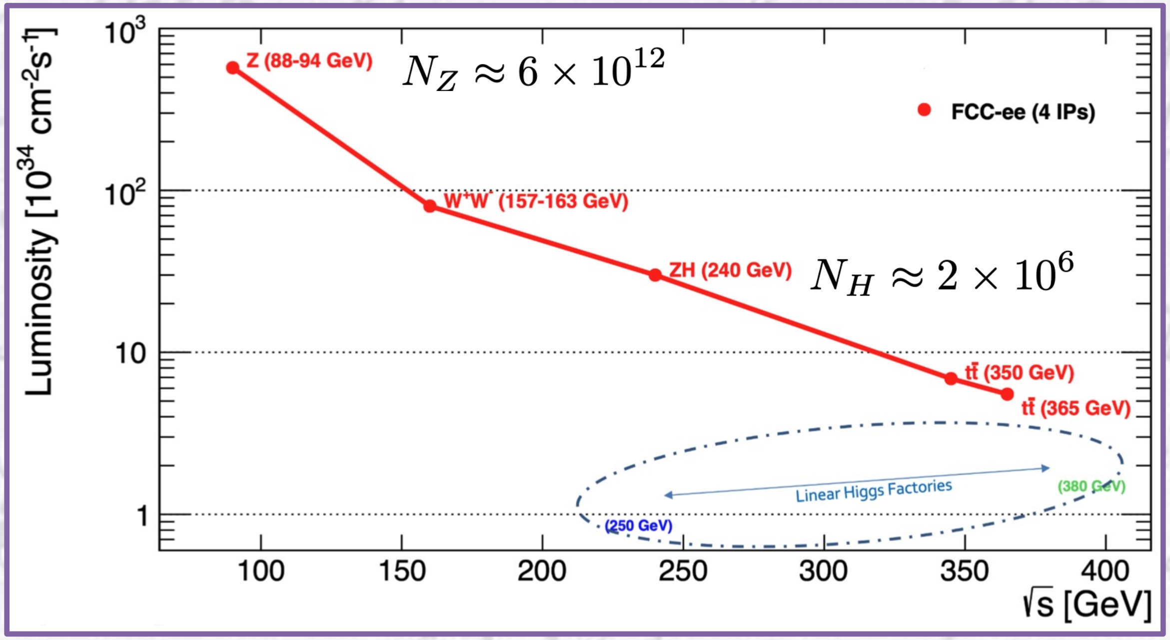
Geographic balance

Country	Count
AT	2
BE	1
CH	33
↳ CERN	30
CO	1
DE	16
DK	1
ES	5
FR	12
IN	1
IT	14
JP	1
KR	2
NL	1
PL	5
SI	1
UK	8
US	18
Grand Total	122

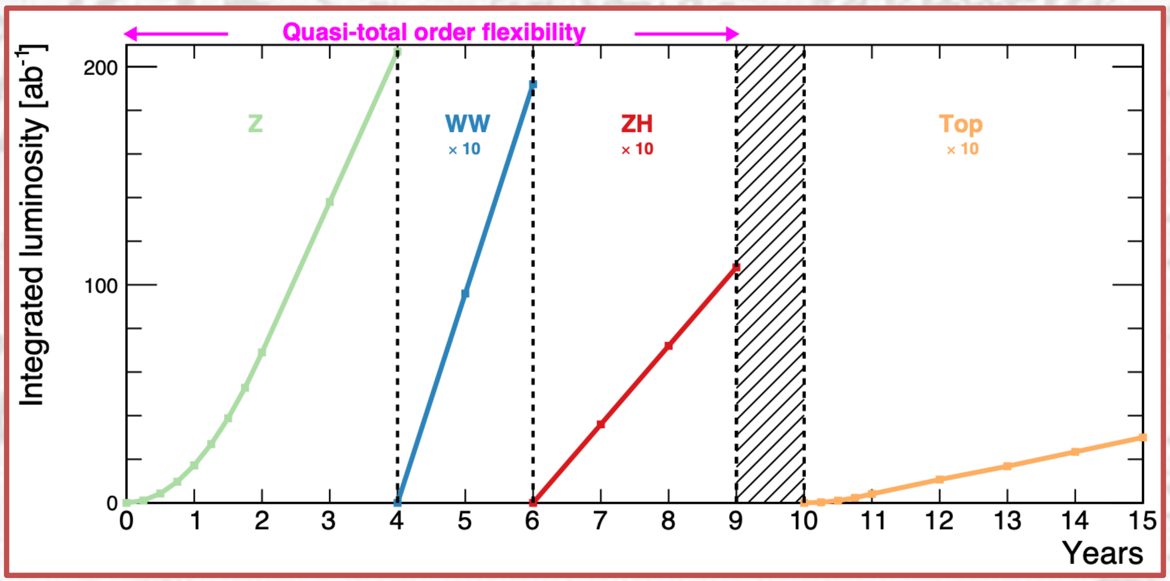


Profile	Count
EXP	89
TH	33
Grand Total	122

Higgs Factory Basics



Luminosity determines The number of collisions observed at a given energy.



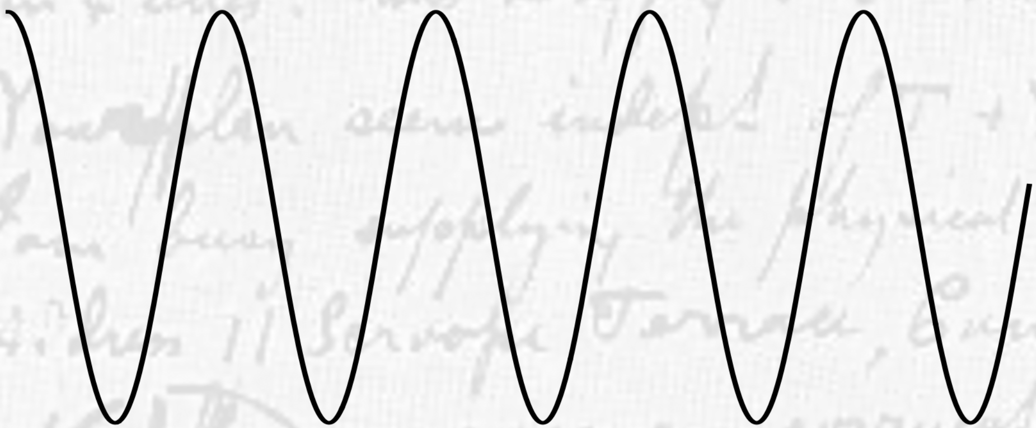
A lot of flexibility with running schedule.

2505.00272

Zooming in on the Higgs

Is the Higgs Fundamental?

The Higgs boson has a size/wavelength. What's inside?



Precision measurements are different ways of probing the "compositeness" of the Higgs Boson.

$$\lambda_h \approx 10^{-17}\ \text{m}$$

$$\lambda_{10\ \text{TeV}} \approx 10^{-19}\ \text{m}$$

Composite Higgs

Compositeness is encoded by periodic coupling functions, where "f" is the compositeness scale. This leads to coupling deviations scaling as

$$\cos\frac{v}{f} \approx 1 - \frac{v^2}{2f^2}$$

The better we measure Higgs couplings, the better we probe compositeness.

Coupling	HL-LHC	FCC-ee
κ_Z (%)	1.3*	0.10
κ_W (%)	1.5*	0.29
κ_b (%)	2.5*	0.38 / 0.49
κ_g (%)	2*	0.49 / 0.54
κ_τ (%)	1.6*	0.46
κ_c (%)	–	0.70 / 0.87
κ_γ (%)	1.6*	1.1
$\kappa_{Z\gamma}$ (%)	10*	4.3
κ_t (%)	3.2*	3.1
κ_μ (%)	4.4*	3.3
$\lvert\kappa_s\rvert$ (%)	–	$^{+29}_{-67}$
Γ_H (%)	–	0.78

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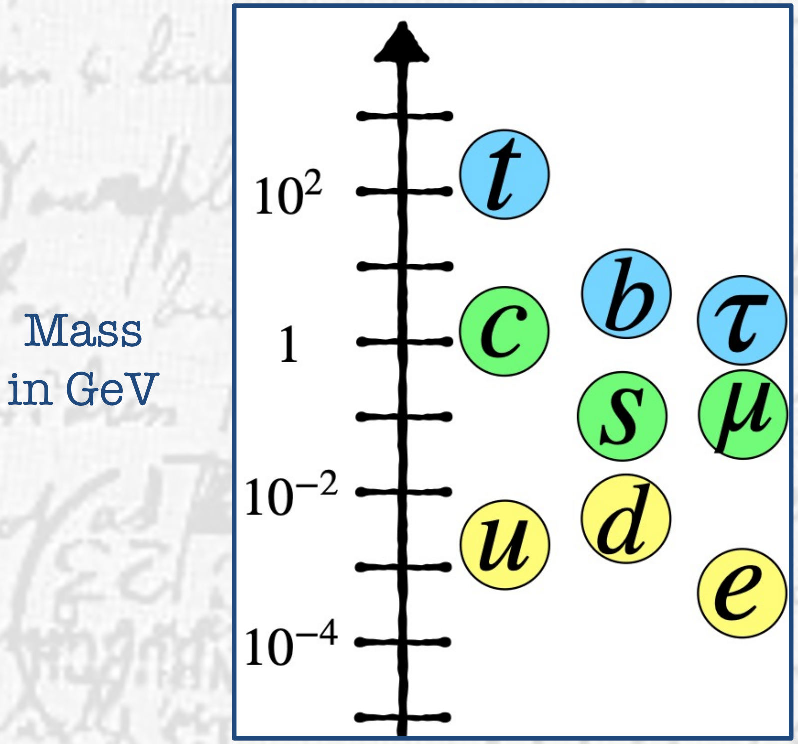
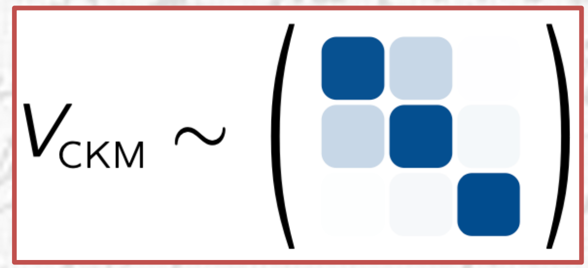
Where do matter mass patterns come from?





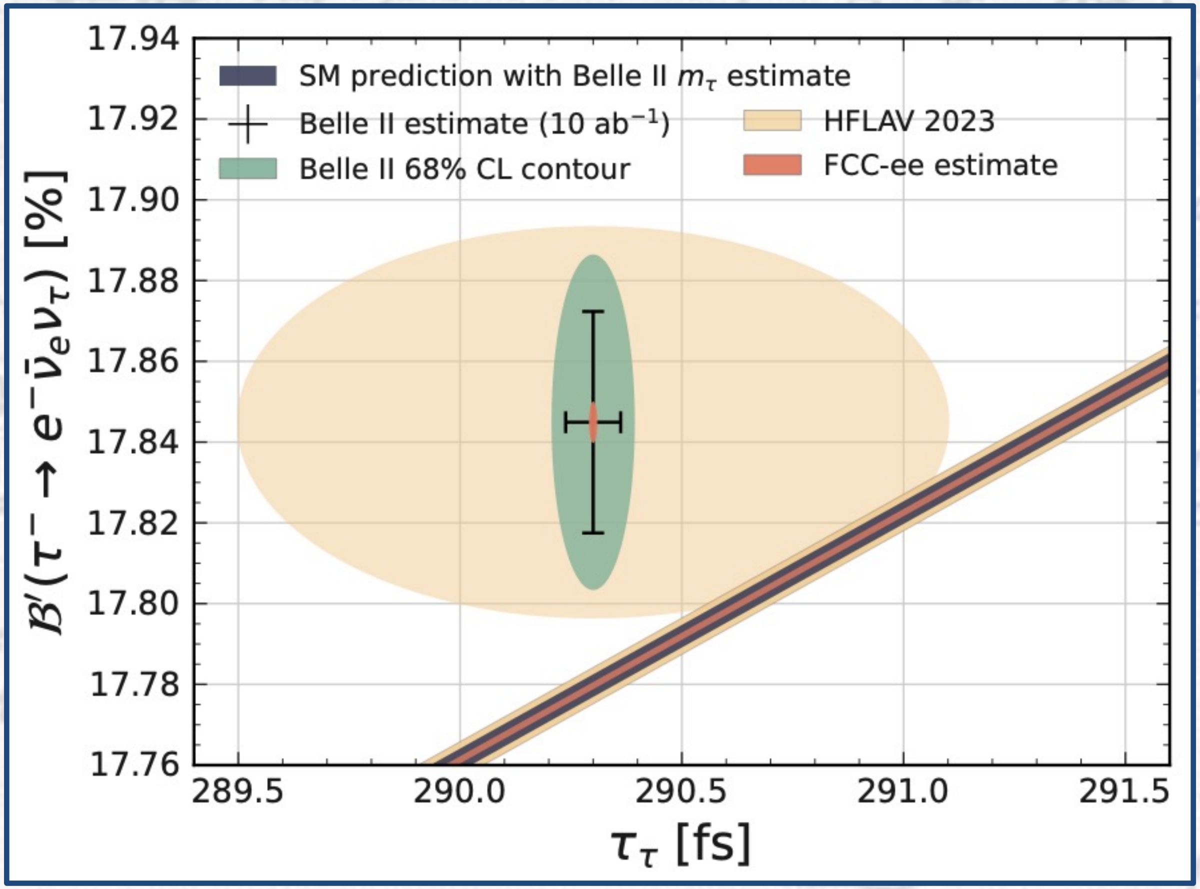
Clearly something going on here... Present state of affairs à la Periodic Table, if we're being honest with ourselves...

Figures borrowed from A. Greljo.

6000000000000 Clean Z-Bosons

Particle production (10^9)	B^0 / $\overline{B}^0$	B^+ / B^-	B_s^0 / $\overline{B}_s^0$	Λ_b / $\overline{\Lambda}_b$	$c\overline{c}$	τ^-/τ^+
Belle II	27.5	27.5	n/a	n/a	65	45
FCC-*ee*	300	300	80	80	600	150

Incredible flavour factory!



Taken from 2511.03883

6000000000000 Clean Z-Bosons

Particle production (10^9)	B^0 / $\overline{B}^0$	B^+ / B^-	B^0_s / $\overline{B}^0_s$	Λ_b / $\overline{\Lambda}_b$	$c\overline{c}$	τ^-/τ^+
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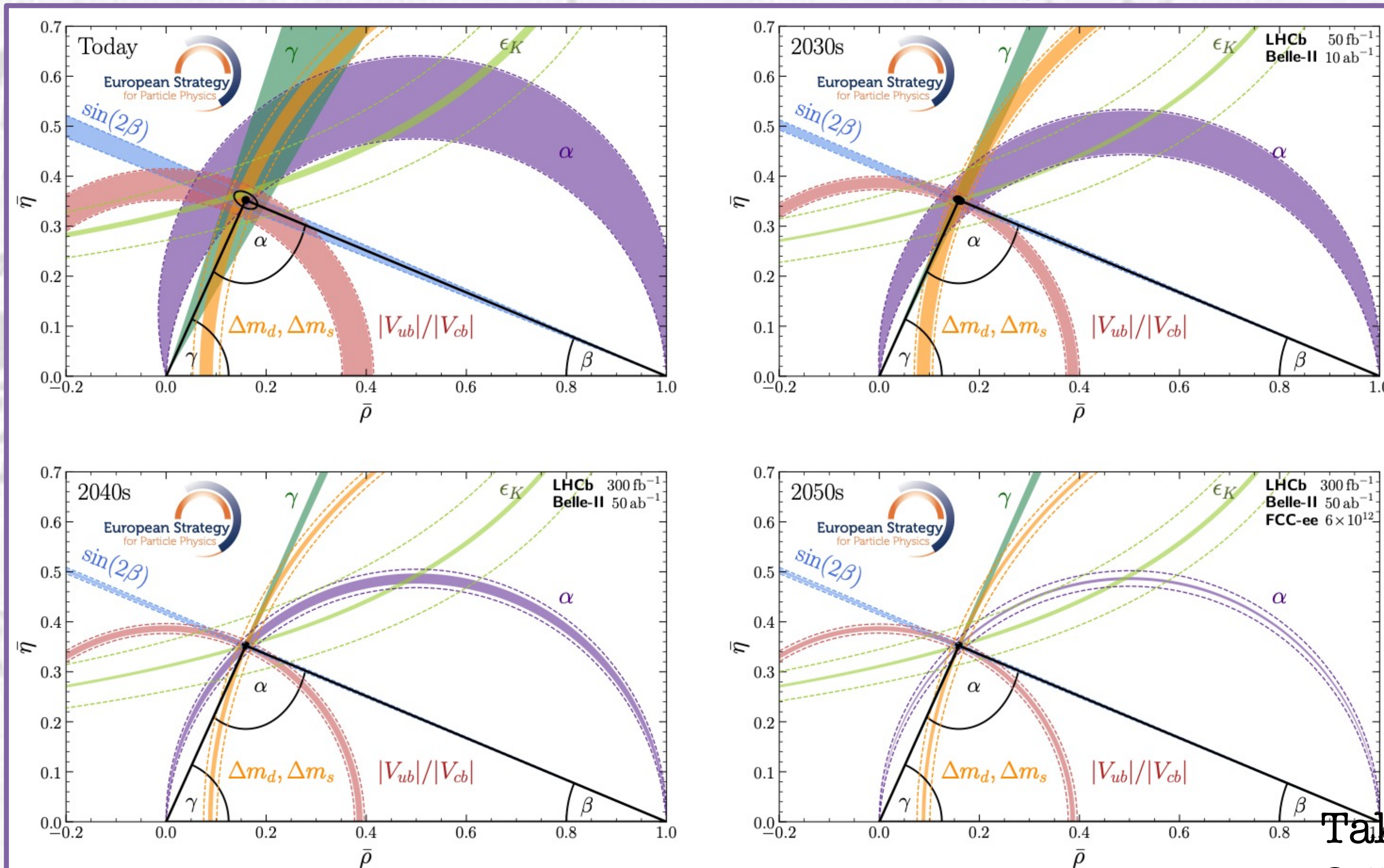
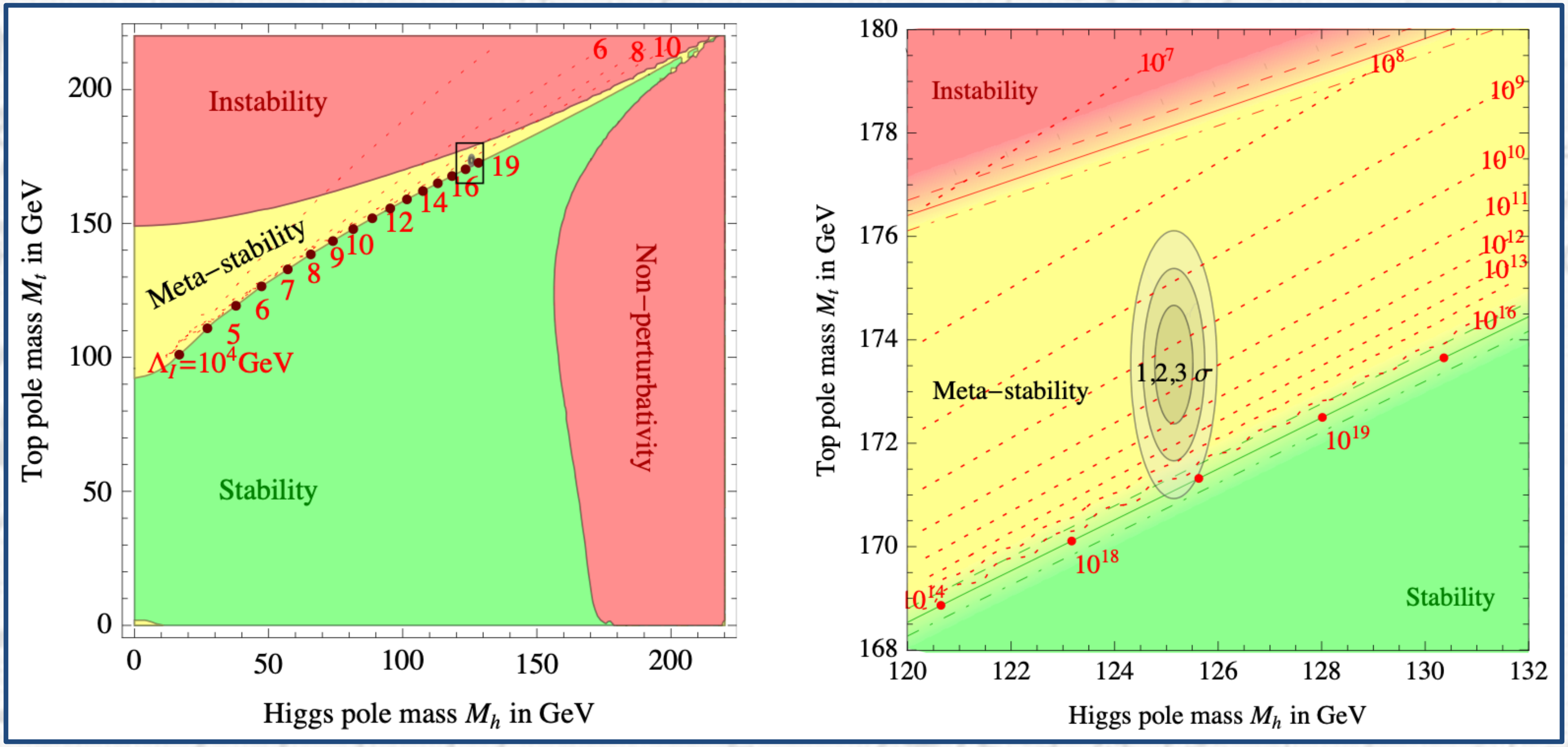


Taken from 2511.03883

Future Precision and the Future

Precision measurements even have implications for our understanding of the fate of our Universe, in the Standard Model.



Taken from 1307.3536

Future Precision and the Future

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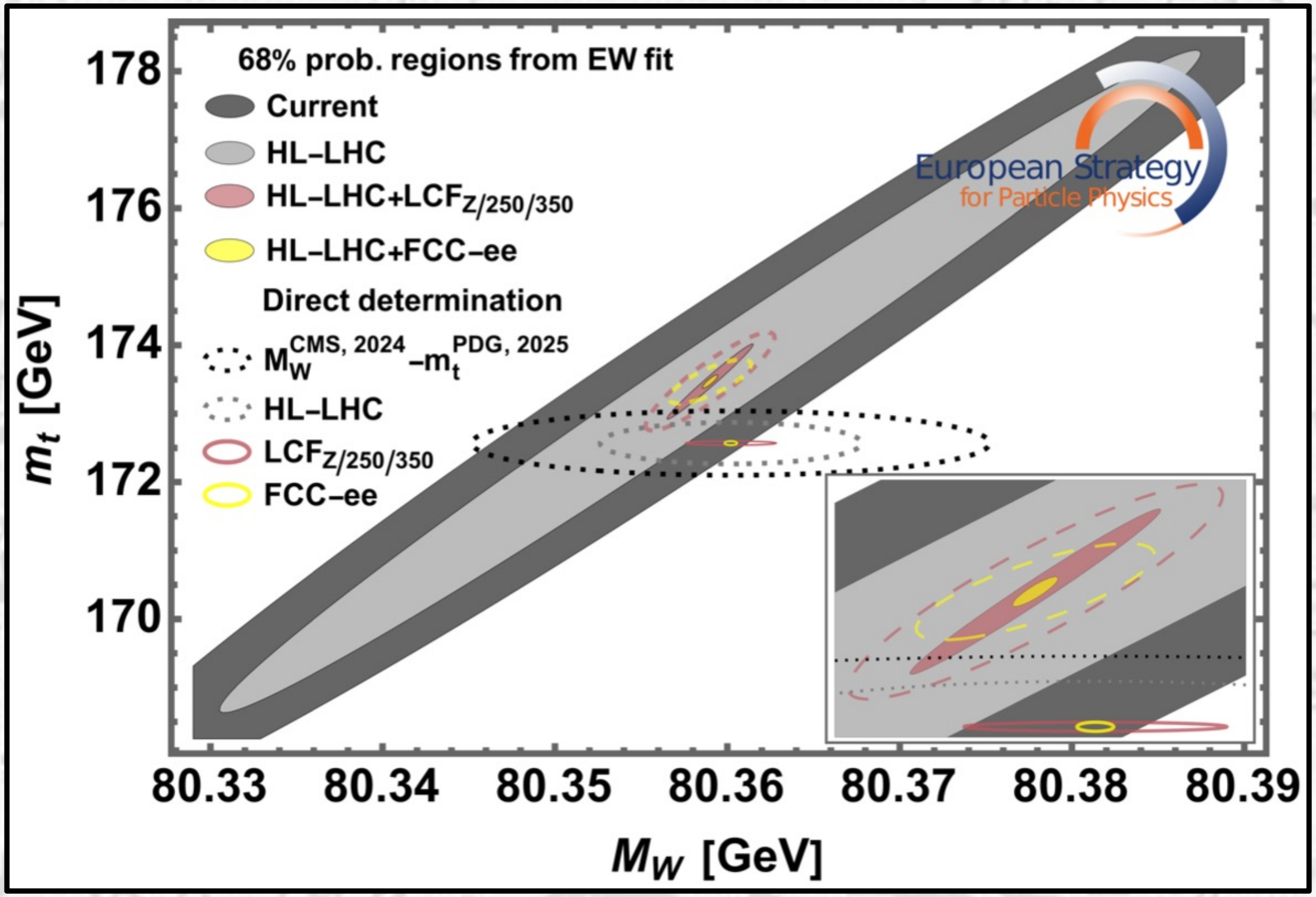


Note different x-axes.

Taken from 2511.03883

Dark Sectors

Evidence for dark matter is now overwhelming

- Rotation curves
- CMB
- Large scale structure
- Velocity dispersions
- Gravitational lensing (Bullet Cluster)
- ....

Yet we have no clue what it is at the particle level!

?

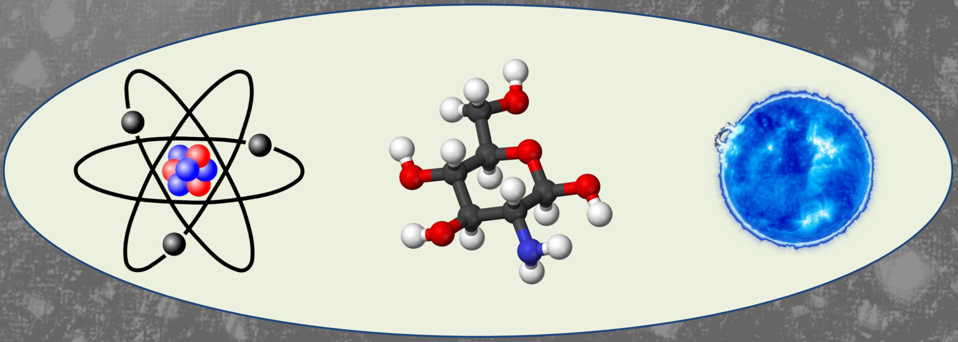
The phenomenology of visible matter is not, to a good approximation, the phenomenology of just hydrogen!

$e \quad u \quad d \quad Z \quad h$

$\mu \quad c \quad s \quad g$

$\tau \quad t \quad b \quad \gamma \quad W$

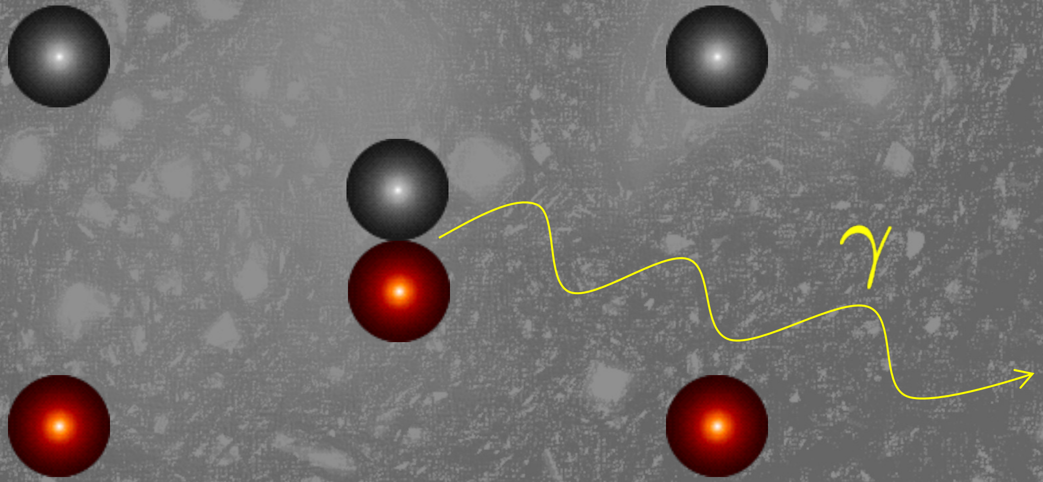
Within the visible 16% we observe extraordinary complexity.



The visible sector is rich, whichever length scale you view it at.

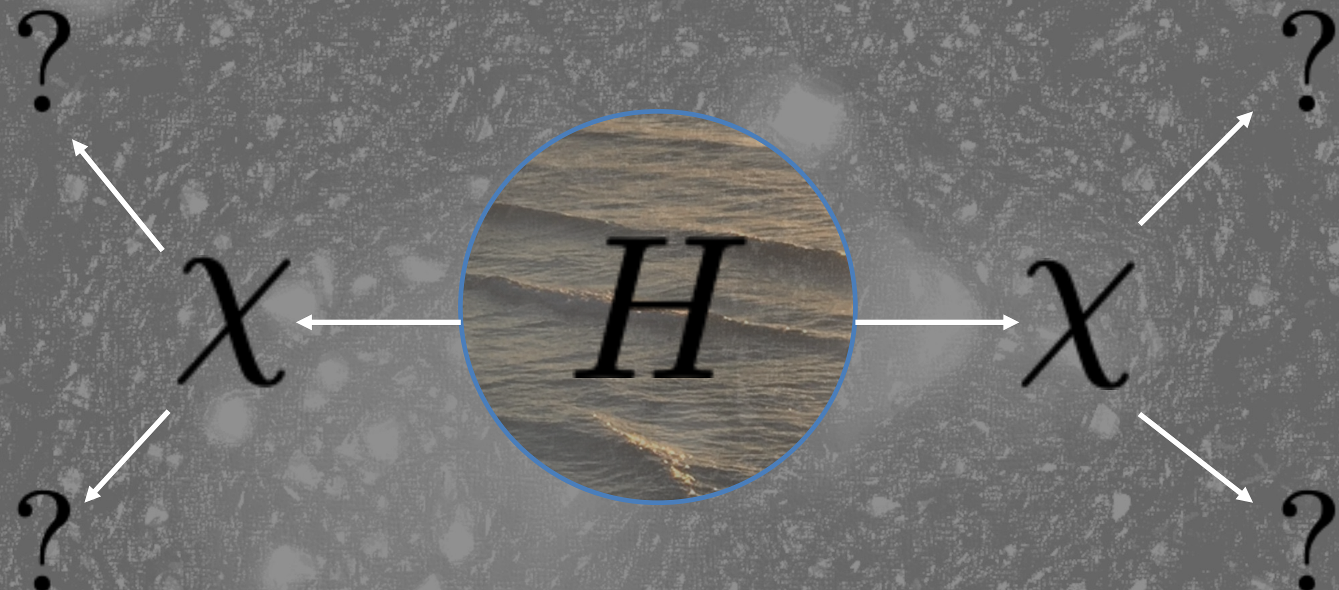
Dark Matters

Often assumed the phenomenology of the dark sector, including interactions with us, is also dominated by a single state.



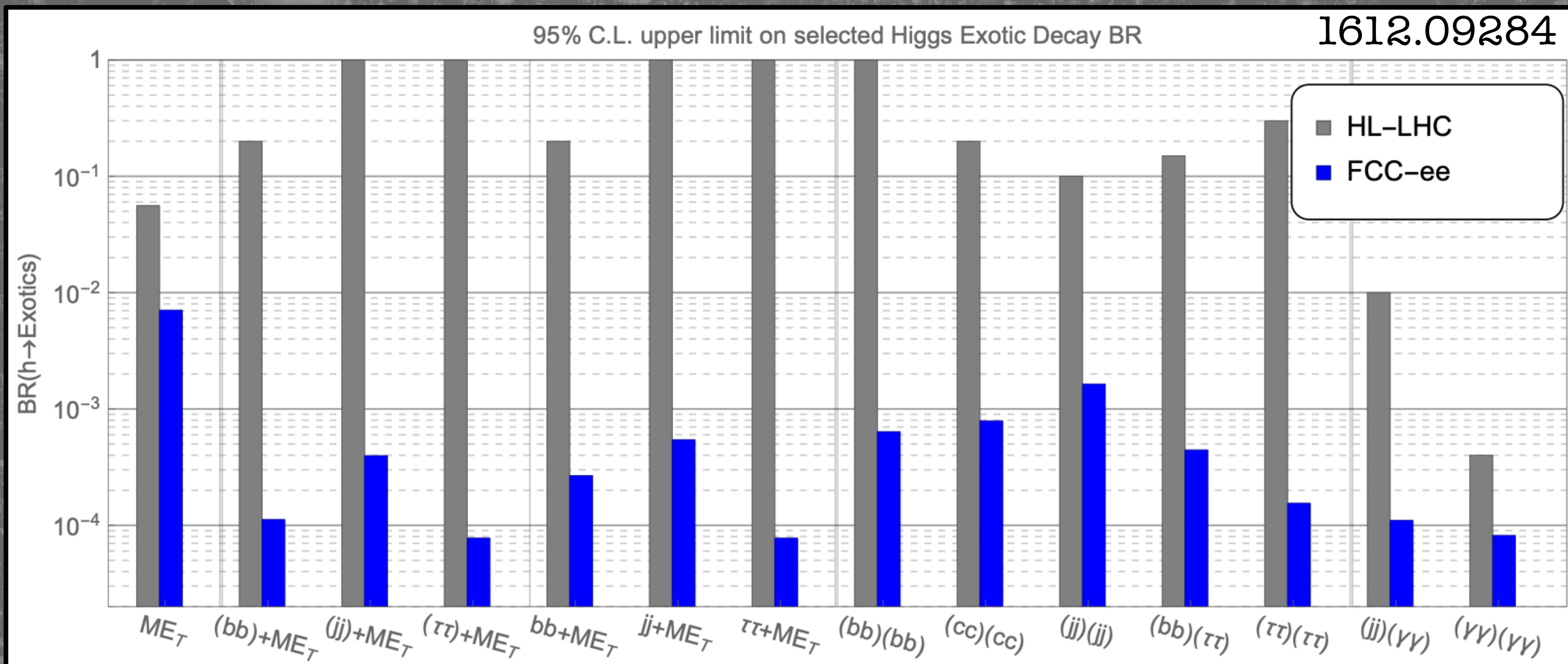
Consider the rich phenomenology of the visible sector. Why should the dark sector be simple?

Is the Higgs a portal to new dark sector states?



After all, the Higgs has the most relevant interaction involving SM fields!

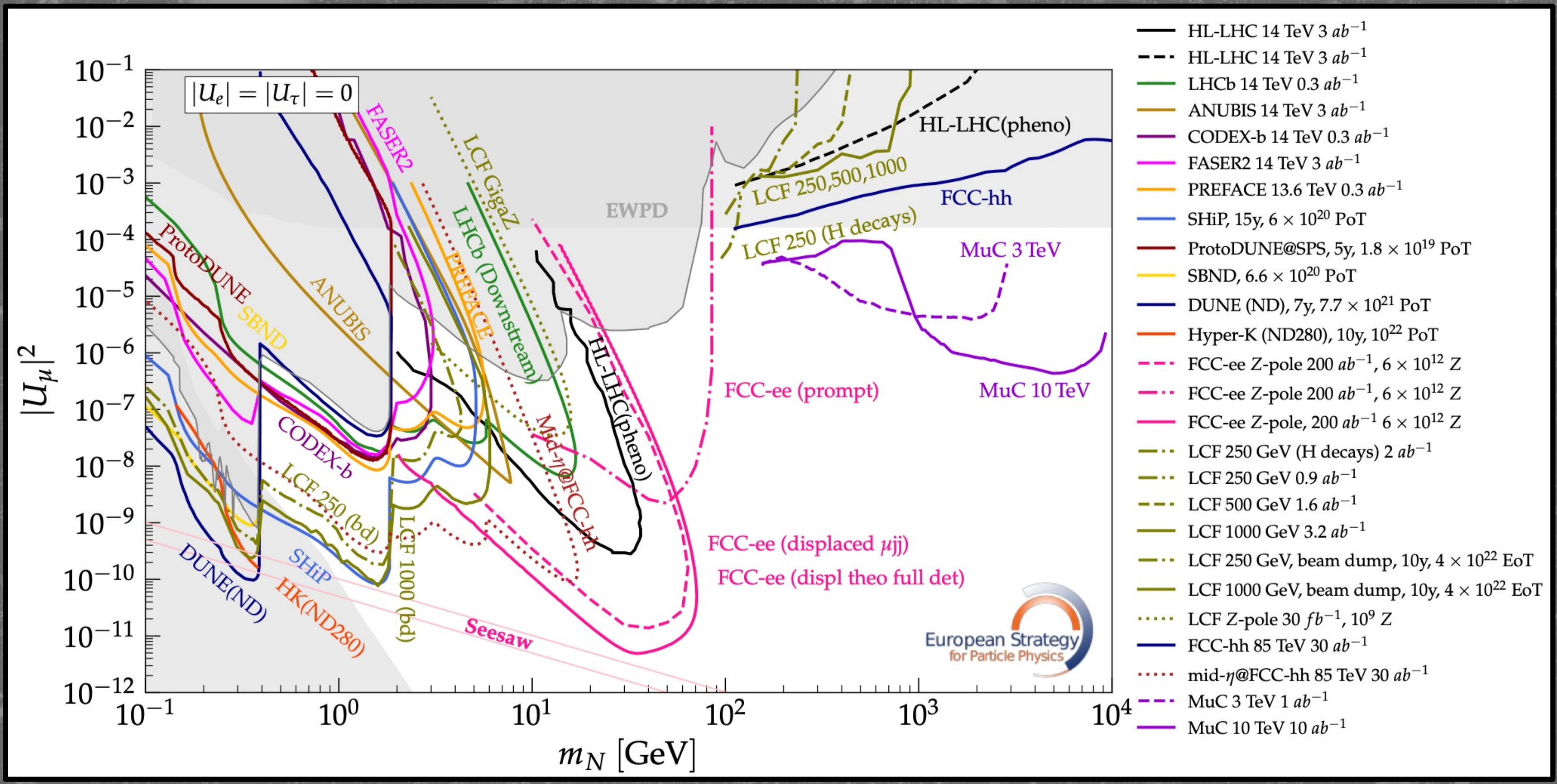
Is the Higgs a portal to new dark sector states?



FCC offers incredible improvement in coverage of exotic Higgs decays.

Is the Z Boson a portal to new dark sector states?

2511.03883



Tera-Z brings the intensity frontier to new frontiers, in this case through the neutrino portal.

Immense Theory Opportunities

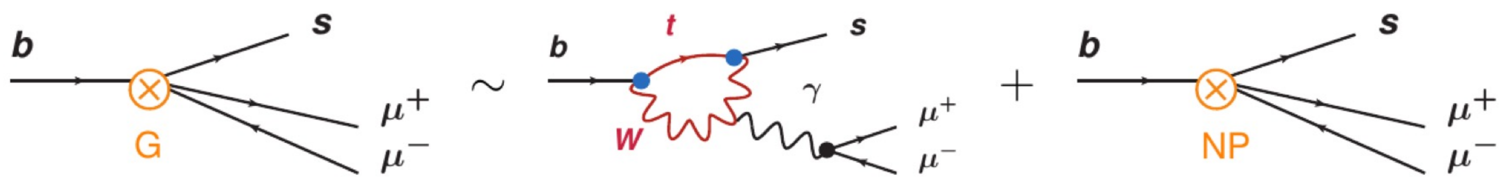
Example: Precision

Quantity	Current precision	FCC-ee stat. (syst.) precision	Required theory input	Theory status as of today	Needed theory improvement†
m_Z (MeV)	2.0	0.004 (0.1)	non-resonant $e^+e^- \to f\bar{f}$, initial-state radiation (ISR)	NLO, ISR logarithms up to 6$^{\text{th}}$ order	NNLO for $e^+e^- \to f\bar{f}$
Γ_Z (MeV)	2.3	0.004 (0.012)			
$\sin^2\theta^\ell_{\text{eff}}$	1.6×10^{-4}	$1.2\ (1.2)\times10^{-6}$			
m_W (MeV)	9.9	0.18 (0.16)	lineshape of $e^+e^- \to WW$ near threshold	NLO ($e^+e^- \to 4f$ or EFT framework)	NNLO for $e^+e^- \to WW$, $W \to f\bar{f}'$ in EFT setup
HZZ coupling	– *	0.1%	cross section for $e^+e^- \to ZH$	NLO EW plus partial NNLO QCD/EW	full NNLO EW
m_{top} (MeV)	290	4.2 (4.9)	threshold scan $e^+e^- \to t\bar{t}$	N^{3}LO QCD, NNLO EW, resummations up to NNLL, $\mathcal{O}$(30 MeV) scale uncert.	Matching fixed orders with resummations, merging with MC, α_S (input)

2505.00272

Immense Theory Opportunities

Example: Flavour



$$G \sim \frac{1}{16\pi^2}\frac{g^4}{m_W^2}\frac{m_t^2}{m_W^2} V_{tb} V_{ts}^* + \frac{C_{NP}}{\Lambda_{NP}^2}$$

measure precisely

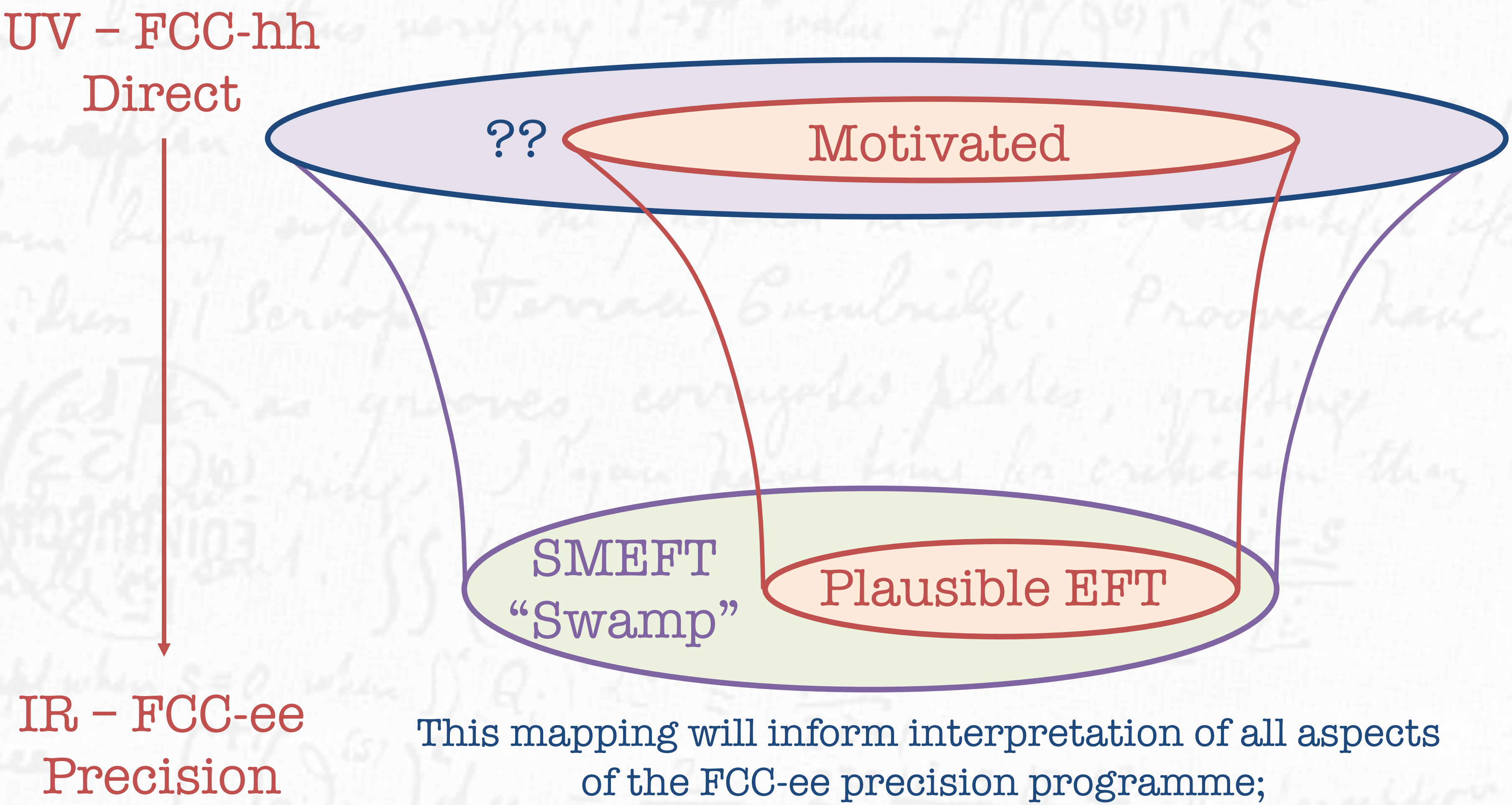
calculate precisely the SM contribution

get information on NP coupling and scale

Altmannshofer: Flavours at FCC Workshop, CERN, June 2026

Immense Theory Opportunities

Example: BSM Mapping

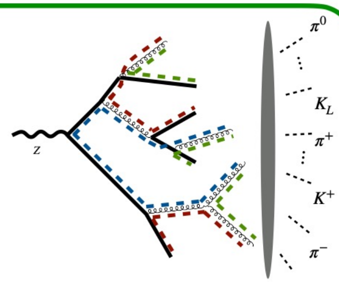


This mapping will inform interpretation of all aspects of the FCC-ee precision programme; Higgs, EW, Flavour, QCD and tie them together through correlated effects.

Immense Theory Opportunities

Example: Non-Perturbative QCD

Monte Carlo generators



Higher-order PS with tuned hadronization models: needs data at different energies

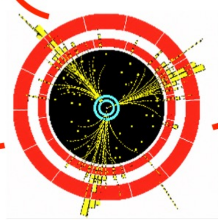
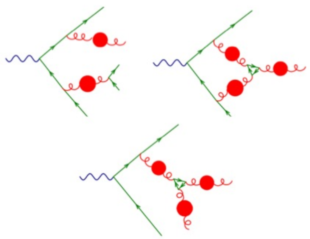


Fig. credits: Nason et al.

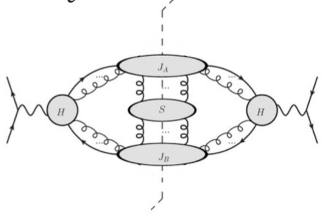
Analytic models



Extract non-perturbative information from simplified theories (e.g. large-n_F QCD)

Fig. credits: K. B. Chen et al.

Factorisation theorems, EFTs



Separation of long/short distance physics + RG evolution (e.g. fragmentation functions)

All programs require a dedicated effort to achieve the level of control needed for FCC-ee. Non-perturbative QCD corrections constitute one of the main obstacles to reach the desired precision across several measurements

Role of CERN-TH in FCC

Acting as a central hub to facilitate and coordinate global theory activities towards:

- Building and reinforcing FCC Theory community.
- Ensuring active communication and collaboration across activities.
- Serving in key roles across coordination.
- Directly attacking the theory challenges.

Present support includes:

- Hosting numerous regular in-person workshops and schools (Precision Calculation school and workshop in last two weeks, graduate school in August, topical workshops).
- Hosting theory visitors and junior colleagues on contracts of a few days (STV) to months (SASS) to years (2 FCC Fellow positions).

CERN-TH Collaboration with German Theory Hub (GTH)

Potential aspects of synergy and collaboration include:

- **Preserving knowledge** and skills built over decades and transmitting this to future generations of theorist through joint schools.
- **Amplifying visibility** and impact of GTH activities by providing a platform for dissemination of new results and formation of new collaborations with dedicated workshops.
- **Mobility** between CERN-TH and GTH researchers, supporting CERN-TH travel to GTH centres and supporting GTH visits to CERN-TH.
- Supporting possible **career pipeline** opportunities for young theorists trained within GTH.
- **Technical support** for maintenance of required theory tools.
- **Enhancing recognition** for important contributions.

Remarks

We stand at a critical juncture in fundamental physics. Such moments present unique opportunities for establishing the needed leadership to shepherd decades of scientific and technological progress.

The DE physics community is singularly placed to assume a scientific leadership capacity thanks to the unique depth and breadth of established competencies in particle theory across all areas of technical relevance.