Beyond the Standard Model Higgs at CEPC

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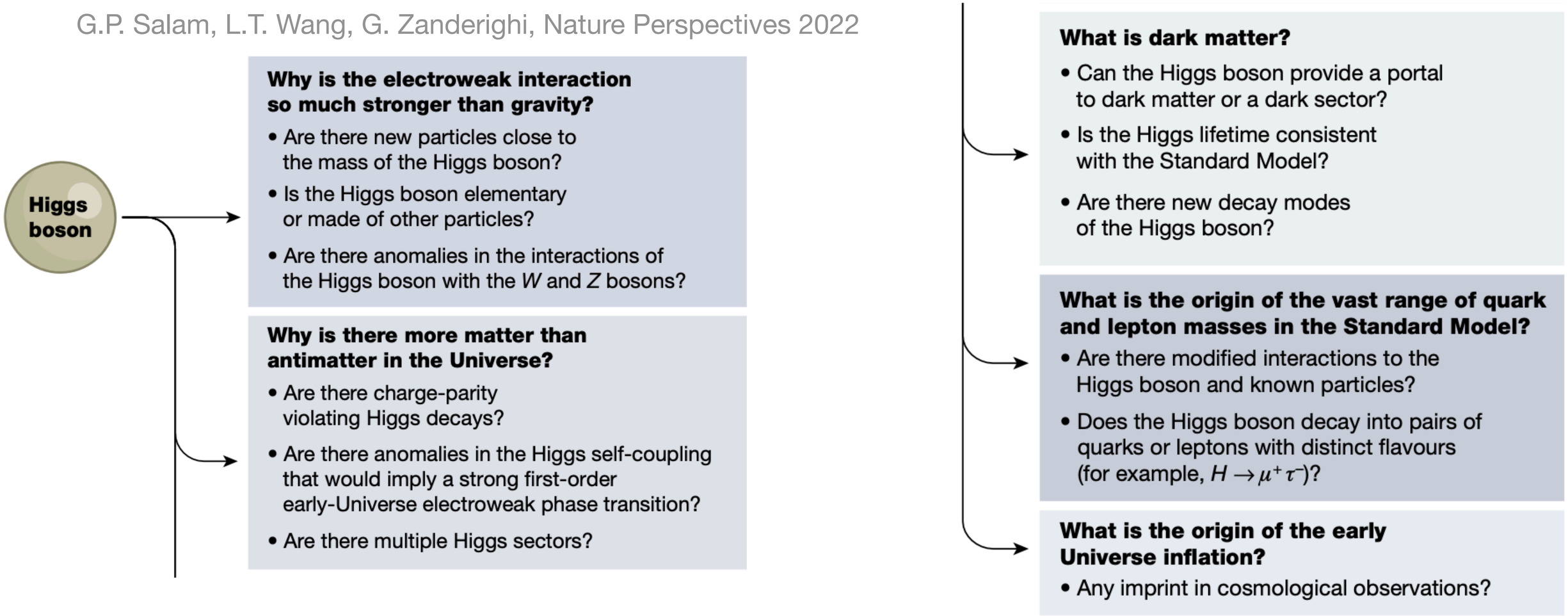
2023-10-23

Outline

- Introduction
- BSM Higgs studies
  - Higgs Exotic Decay
  - Exotic Light Higgs Searches
  - Dark Sector scalars or pseudo-scalars at Z-Factory
  - Higgs invisible decay for Higgs Portal Dark Matter
- Summary

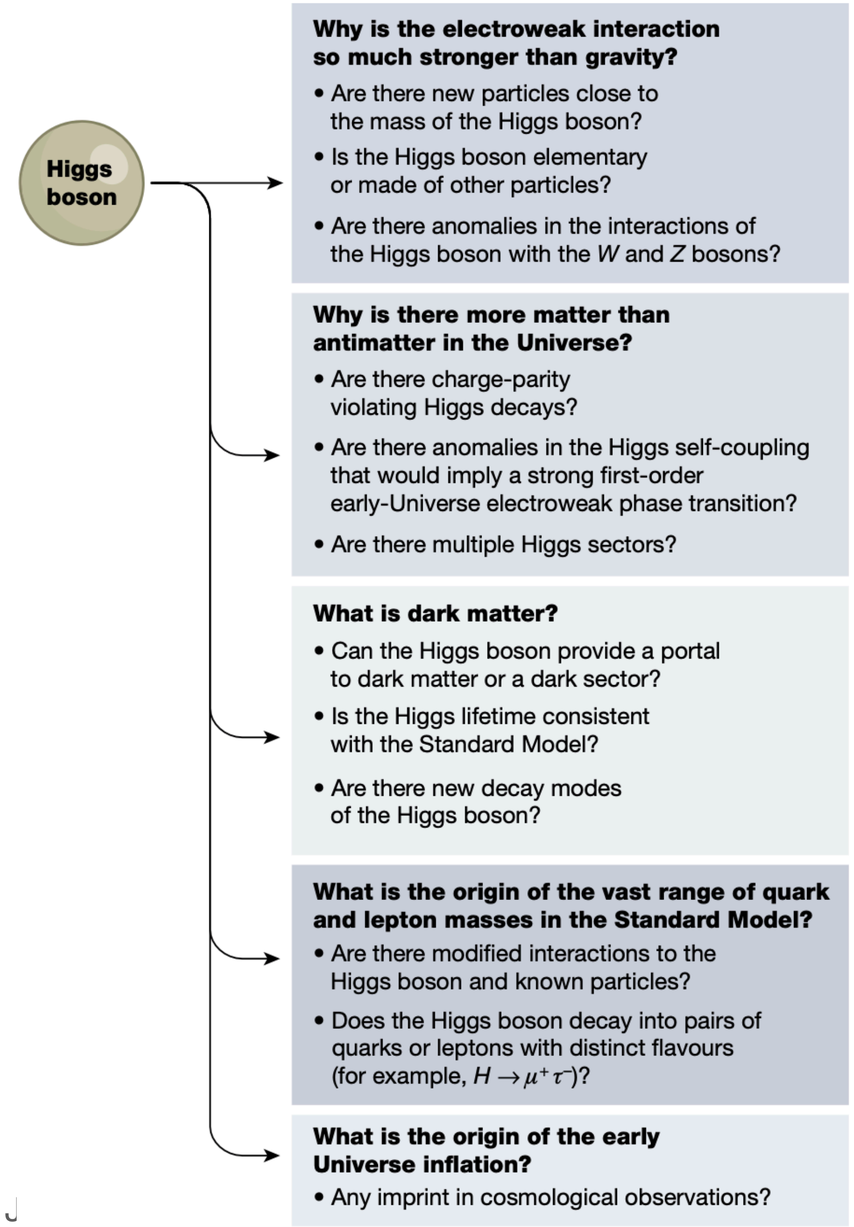
The Higgs boson turns ten in 2012

G.P. Salam, L.T. Wang, G. Zanderighi, Nature Perspectives 2022



- Higgs could be the key of the particle physics open questions

The Higgs boson turns ten in 2012

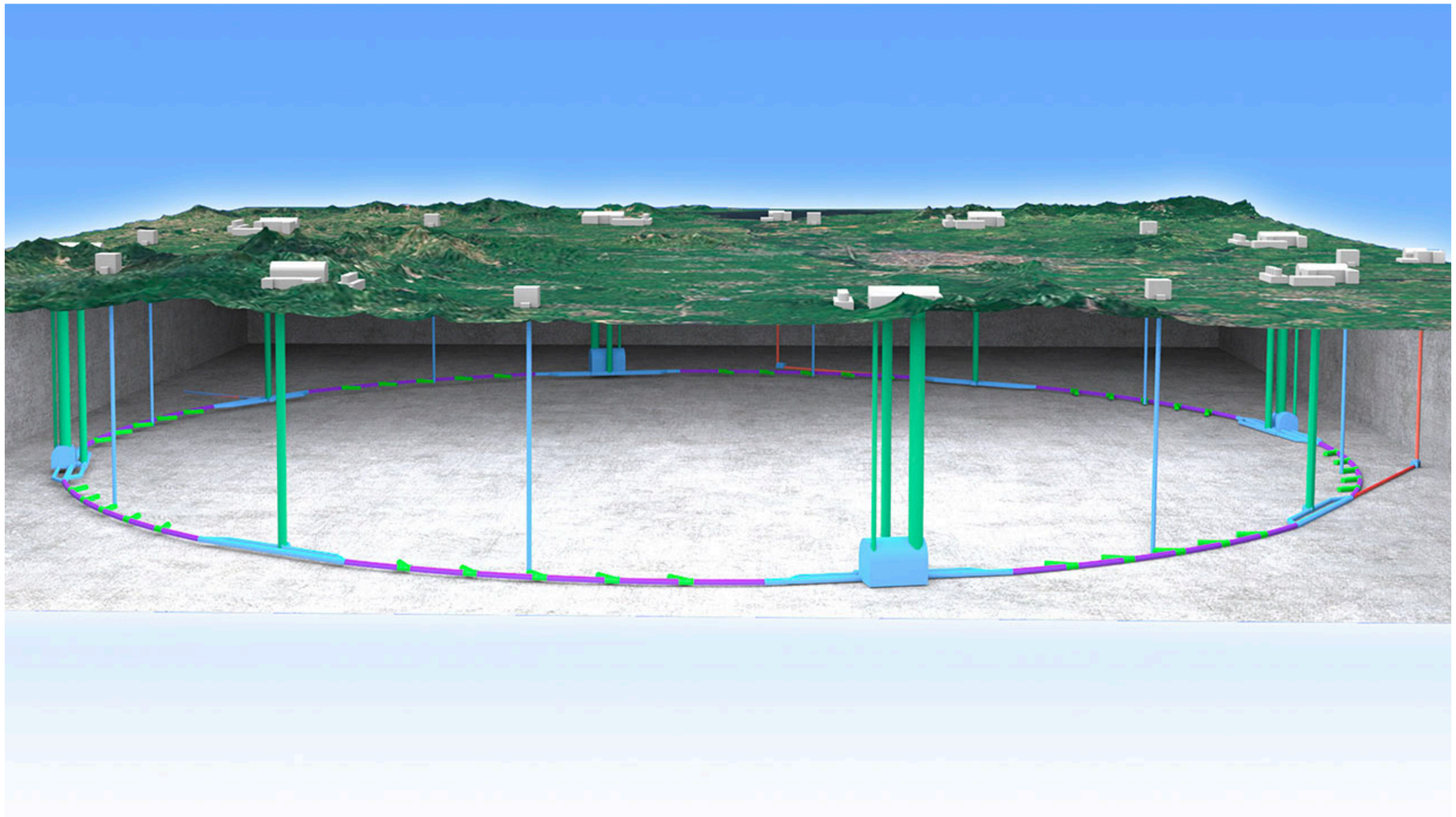


- Higgs could be the key of major particle physics open problems
- Use the Higgs boson as a new tool for discovery
  (Particle Physics Project Prioritization Panel (P5) Strategic Planning 2019)
- Higgs factory is the way to go!

G.P. Salam, L.T. Wang, G. Zanderighi, Nature Perspectives 2022

CEPC and its precision approach to new territories

- A Higgs factory running at 240 GeV with e^+e^- collision
- Later it has added Z, WW, $\bar{t}t$ runs to broadening the physics scope
- It is a multi-purpose precision machine



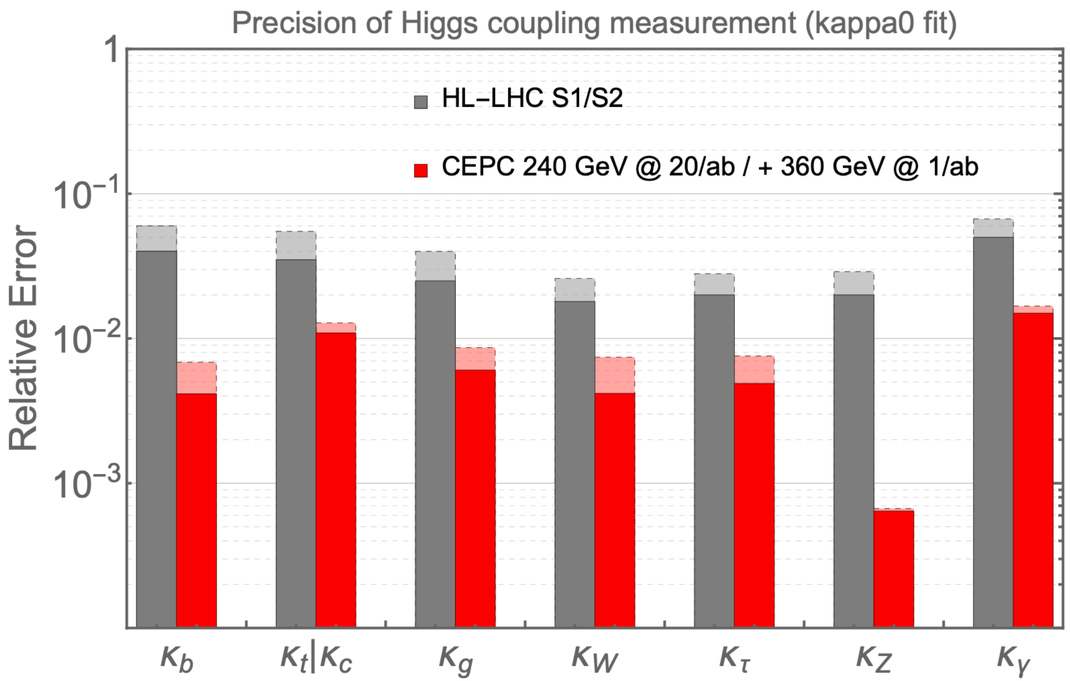
CEPC physics goal

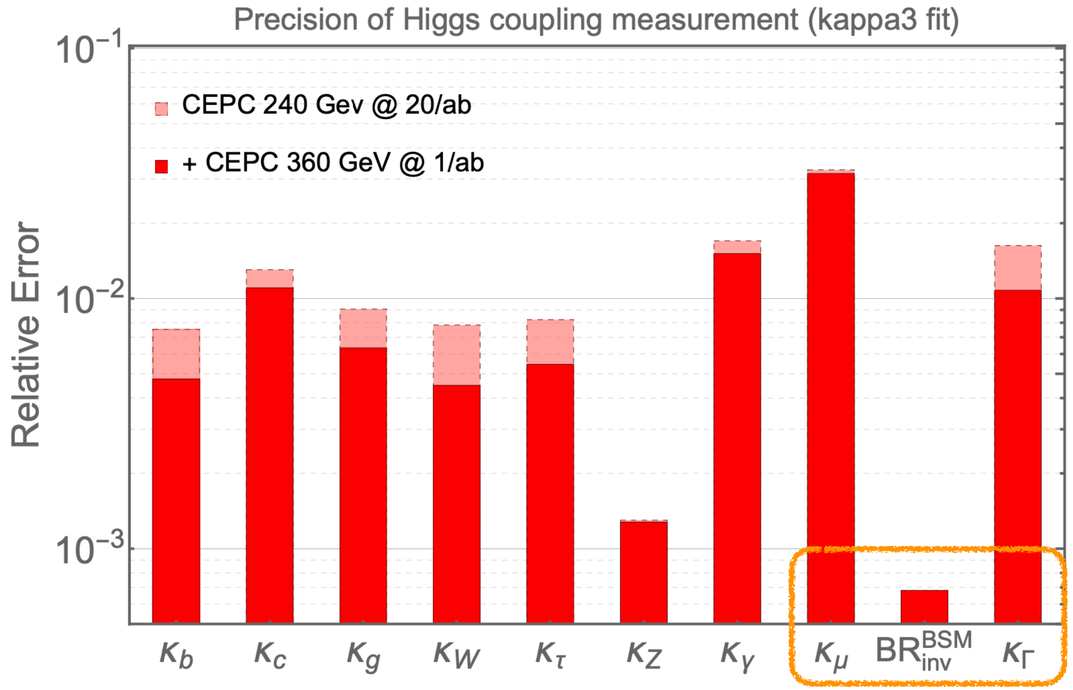
Operation mode		ZH	Z	W^+W^-	$t\bar{t}$
$\sqrt{s}$ [GeV]		240	91	160	360
Run time [years]		7	2	1	-
CDR (30 MW)	L / IP [$\times 10^{34}$ cm^{-2}s^{-1}]	**3**	**32**	**10**	-
	$\int L\,dt$ [ab^{-1}, 2 IPs]	5.6	16	2.6	-
	Event yields [2 IPs]	1×10^{6}	7×10^{11}	2×10^{7}	-
Run Time [years]		10	2	1	5
TDR (Latest) 30 MW	L / IP [$\times 10^{34}$ cm^{-2}s^{-1}]	**5.0**	**115**	**16**	0.5
	$\int L\,dt$ [ab^{-1}, 2 IPs]	13	60	4.2	0.65
	Event yields [2 IPs]	2.6×10^{6}	2.5×10^{12}	1.3×10^{8}	4×10^{5}
TDR (Latest) 50 MW	L / IP [$\times 10^{34}$ cm^{-2}s^{-1}]	**8.3**	**192**	**26.7**	**0.8**
	$\int L\,dt$ [ab^{-1}, 2 IPs]	21.6	100	6.9	1.0
	Event yields [2 IPs]	4.3×10^{6}	4.1×10^{12}	2.1×10^{8}	6×10^{5}

- Precision measurement of Higgs boson (width, couplings, mass, decay channels…)
- Precision test on SM for electroweak, flavor, and QCD physics
- Exotics from H (4M), Z (4T), W (200M) and top (~1M) measurements
- Searching for BSM physics

The progress of electroweak studies at CEPC

- Precision Higgs coupling measurement
  - Reaching 0.1%-1% of precision
  - Muon coupling, invisible BR and total width measurements





Physics potential of CEPC, 2205.08553 (snowmass 2021)

The progress of electroweak studies at CEPC

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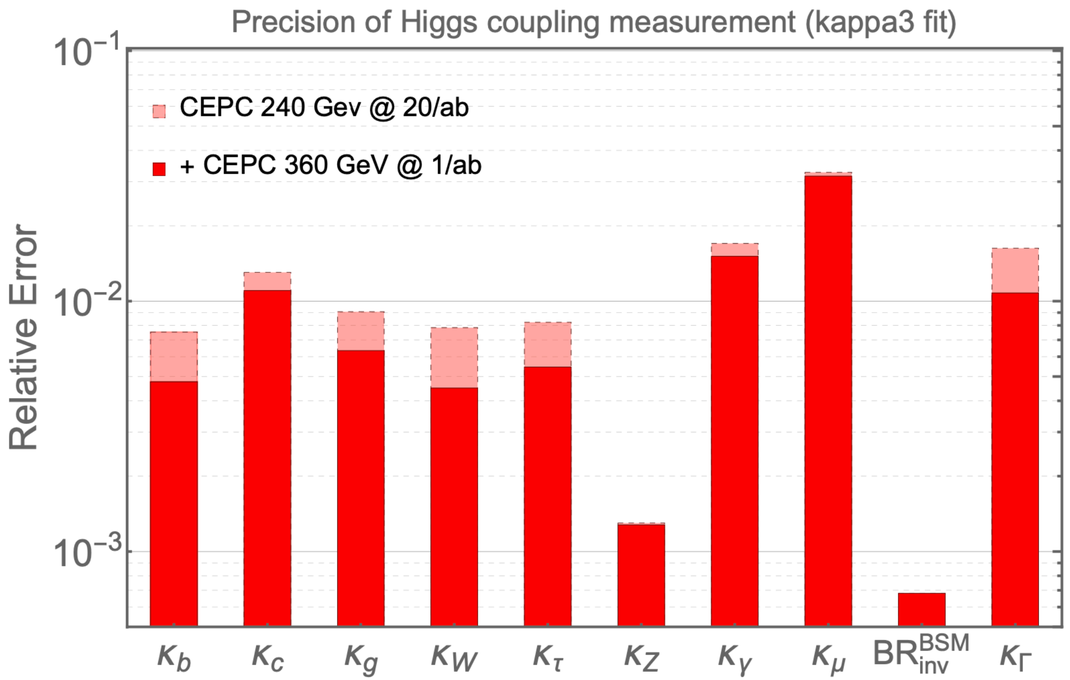
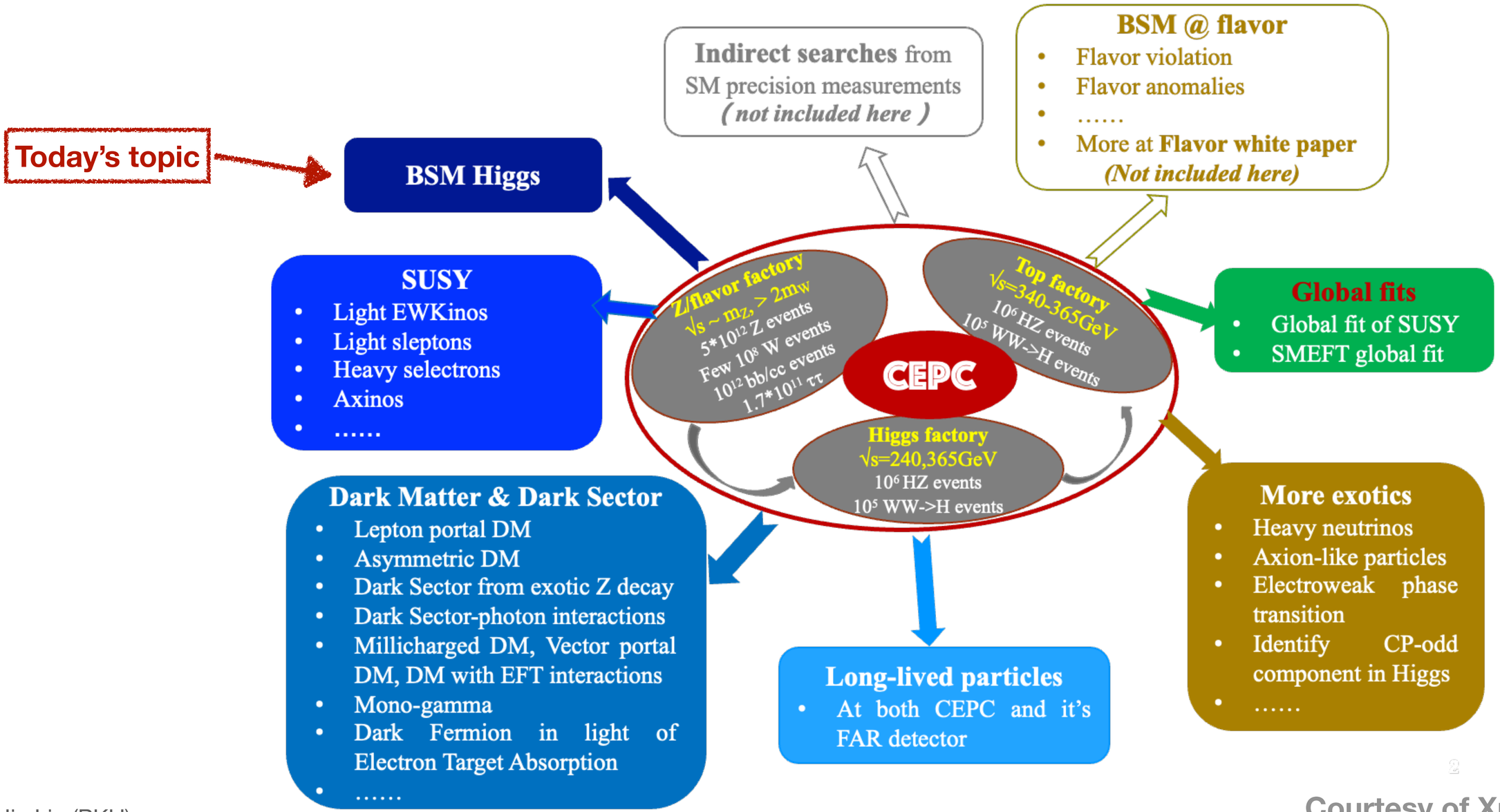


	240 GeV, 20 ab^{-1}		360 GeV, 1 ab^{-1}		
BR	ZH	**vvH**	ZH	**vvH**	**eeH**
inclusive	**0.26%**		**1.40%**	\	\
H→bb	**0.14%**	**1.59%**	**0.90%**	**1.10%**	**4.30%**
H→cc	**2.02%**		**8.80%**	**16%**	**20%**
H→gg	**0.81%**		**3.40%**	**4.50%**	**12%**
H→WW	**0.53%**		**2.80%**	**4.40%**	**6.50%**
H→ZZ	**4.17%**		**20%**	**21%**	
$H \to \tau\tau$	**0.42%**		**2.10%**	**4.20%**	**7.50%**
$H \to \gamma\gamma$	**3.02%**		**11%**	**16%**	
$H \to \mu\mu$	**6.36%**		**41%**	**57%**	
$H \to Z\gamma$	**8.50%**		**35%**		
$\mathrm{Br}_{upper}(H \to inv.)$	**0.07%**				
Γ_H	**1.65%**		**1.10%**		

Physics potential of CEPC, 2205.08553 (snowmass 2021)

CEPC BSM Physics Program



Courtesy of Xuai Zhuang

BSM inputs and status

- BSM Higgs (1709.06103; 1808.02037; 1912.01431; 2008.05492; 2011.04540)
- SUSY Searches
  - Direct SUSY Searches (CPC46(2022)013106; 2101.12131; 2203.10580;2202.11011, 2211.08132)
  - Indirect search of SUSY (2010.09782)
- Dark Matter and Dark Sector searches
  - Lepton portal DM (JHEP 06 (2021) 149)
  - Asymmetric DM (PRD 104(2021)055008)
  - Dark Sector from exotic Z decay (1712.07237)
  - DM (Millicharged DM, Vector portal DM, DM with EFT interactions): 1903.1211
  - Mono-gamma (2205.05560), Dark Sector-photon interactions (2208.08142)
  - Dark Fermion in light of Electron Target Absorption (2306.00657)
- Long-lived particles (1904.10661, 1911.06576, 2201.08960)
- More exotics:
  - Heavy neutrinos (2102.12826, 2201.05831);
  - Axion-like particles (2103.05218, 2204.04702, 2210.09335, J. Phys. G)
  - Electroweak phase transition (1911.10210,1911.10206,2011.04540, 2204.05085)
  - Identify CP-odd component in Higgs study (2212.05390)
  - ……
- Global fits:
  - Global fit of SUSY (2203.04828, 2203.07883)
  - SMEFT global fit (2206.08326)

Courtesy of Xuai Zhuang

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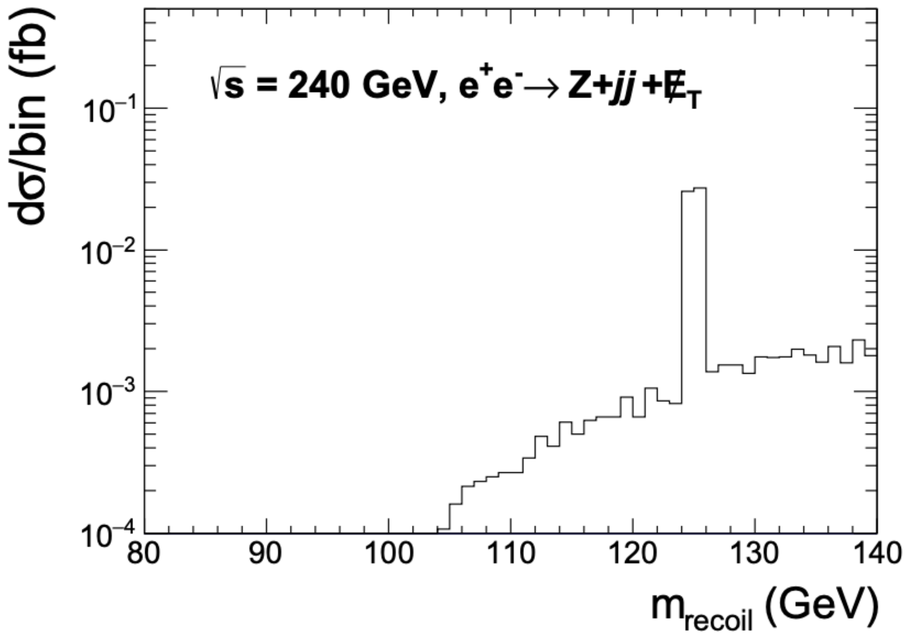
BSM Higgs studies I: Higgs Exotic Decay

Physics potential of CEPC, 2205.08553 (snowmass 2021)

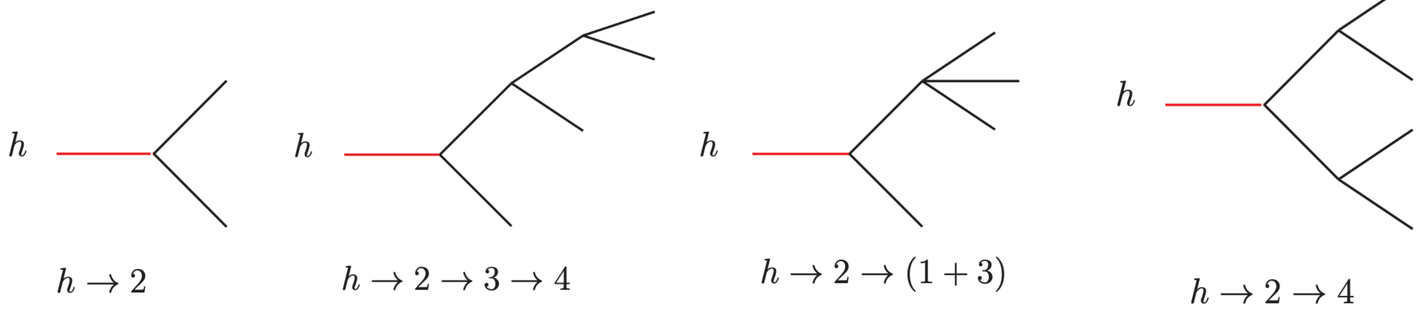
- The Higgs bremsstrahlung production: $e^+e^- \to hZ, Z \to \ell^+\ell^-$
  - CEPC advantage over LHC: initial state is known
  - Enabling "recoil mass" technique: the four-momentum for h is known
  - The partial missing energy final state can be tested at CEPC



BSM Higgs studies I: Higgs Exotic Decay

Physics potential of CEPC, 2205.08553 (snowmass 2021)

- The decay representative topologies: $h \to X_1 + X_2$

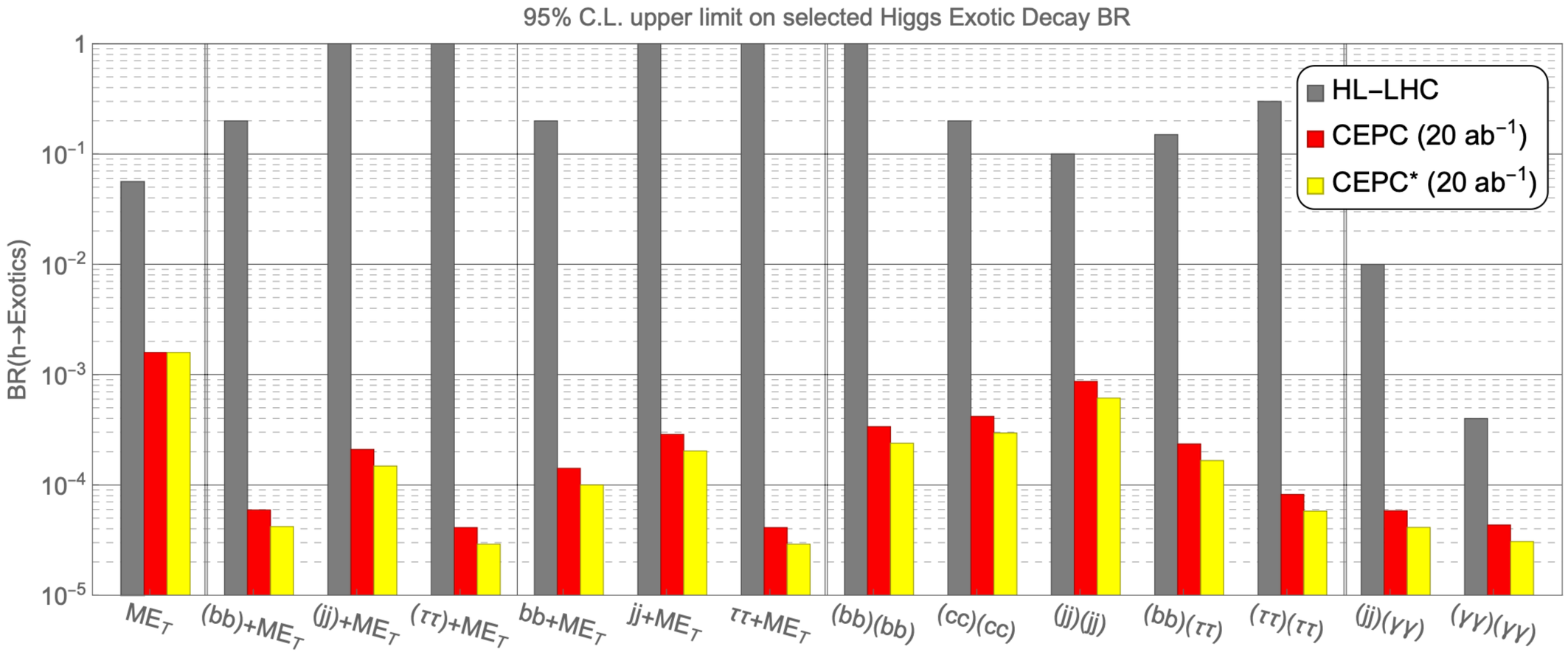


- The particles $X_{1,2}$ maybe detector stable, cascade decay to 2 particles or 3 particles.
- These final state particles can be visible or invisible
  - E.g. from NMSSM: $h \to \tilde{\chi}_1^0 + \tilde{\chi}_2^0, \tilde{\chi}_2^0 \to \tilde{\chi}_1^0 + jj; h \to jj + \text{MissingE}$
  - E.g. from Singlet Scalar ark sector mediator: $h \to s + s \to (jj) + (\chi\chi) \to (jj) + \text{MissingE}$
  - E.g. from Sterile Neutrino: $h \to \nu + N, N \to \nu + jj/\ell^+\ell^-$

BSM Higgs studies I: Higgs Exotic Decay

- CEPC can provide precision test on Higgs exotic decay with production of 4 million Higgs

Physics potential of CEPC, 2205.08553 (snowmass 2021)



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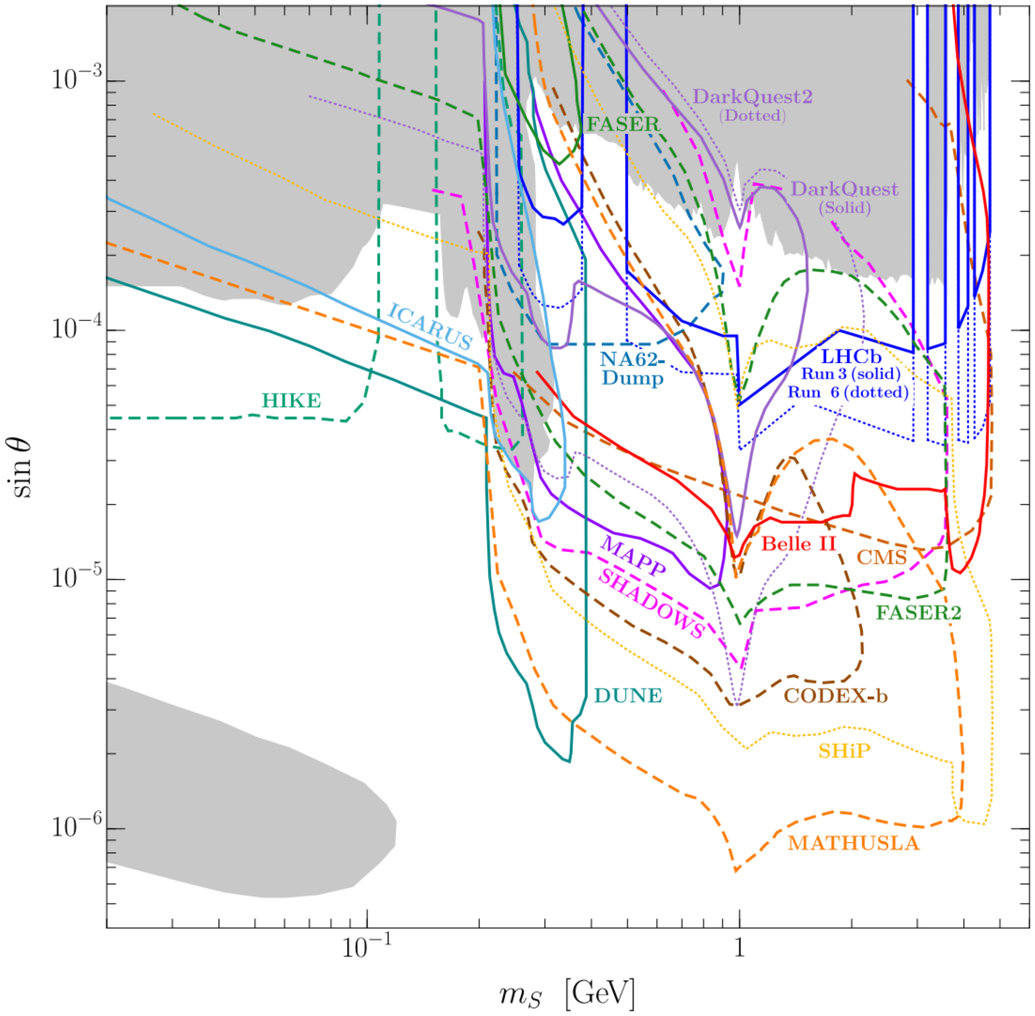
BSM Higgs studies II: Exotic Light Higgs Search

- Before SM Higgs discovery, LEP searched light Higgs for SM
- CEPC should continue this task at higher luminosity and precision:
  - CEPC Advantage: LHC is not good due to large QCD BKG at lower E regions
  - Extra light singlet or Doublet (neutral) Higgs models are common in BSM
    - The scalar potential for 2HDM + Singlet Scalar model
    - Possible light elements:
      CP-even: H_0, s_1
      CP-odd : A_0, s_2
    - The extension of Higgs potential can lead to Strong First Order Phase Transition (SFOPT), see Michael Ramsey-Musolf's talk

$$
\begin{aligned}
V(H_1, H_2, S) =& m_{11}^2\, H_1^\dagger H_1 + m_{22}^2\, H_2^\dagger H_2 \\
&- \mu^2 \left(H_1^\dagger H_2 + H_2^\dagger H_1\right) + \frac{1}{2} m_S^2 S^2 \\
&+ \frac{\lambda_1}{2}\left(H_1^\dagger H_1\right)^2 + \frac{\lambda_2}{2}\left(H_2^\dagger H_2\right)^2 \\
&+ \lambda_3\, H_1^\dagger H_1\, H_2^\dagger H_2 + \lambda_4\, H_1^\dagger H_2\, H_2^\dagger H_1 \\
&+ \frac{\lambda_5}{2}\left[\left(H_1^\dagger H_2\right)^2 + \left(H_2^\dagger H_1\right)^2\right] \\
&+ \frac{\lambda_6}{8} S^4 + \frac{1}{2}[\lambda_7 H_1^\dagger H_1 + \lambda_8 H_2^\dagger H_2] S^2
\end{aligned}
$$

BSM Higgs studies II: Exotic Light Higgs Search

- The vanilla targets for light Higgs (Higgs Portal)
- $$-\mathcal{L} \supset (A\,S + \lambda\,S^2)\,H^\dagger H$$
  - S-h mixing angle θ: $\sin\theta \dfrac{m_f}{v} S\bar{f}f$
  - Two parameters: m_S, $\sin\theta$



Batell, Blinov, Hearty, McGehee, 2207.06905

BSM Higgs studies II: Exotic Light Higgs Search

- More Baroque setup is possible
  - Different mixing angles to different fermions $\epsilon_q \approx \epsilon_W$

$$\mathcal{L}_{\text{eff}} \supset \sum_q \epsilon_q \frac{m_q}{v} \phi \bar{q} q + \sum_\ell \epsilon_\ell \frac{m_\ell}{v} \phi \bar{\ell} \ell + \epsilon_W \frac{2m_W^2}{v} \phi W_\mu^+ W^{\mu-}.$$

- Type-X 2HDM + Singlet

$$\mathcal{L}_{\text{yuk}} = -\lambda_u \bar{Q} \tilde{\Phi}_2 u_R - \lambda_d \bar{Q} \Phi_2 d_R - \lambda_e \bar{L} \Phi_1 e_R + h.c.\,,$$

$$\begin{pmatrix} \sqrt{2}\text{Re}\left[\Phi_1^0\right] \\ \sqrt{2}\text{Re}\left[\Phi_2^0\right] \\ \phi_0 \end{pmatrix} \simeq \begin{pmatrix} \cos\alpha & -\sin\alpha & \sin\theta_{1\phi} \\ \sin\alpha & \cos\alpha & \sin\theta_{2\phi} \\ -\sin\theta_{1\phi} & -\sin\theta_{2\phi} & 1 \end{pmatrix} \cdot \begin{pmatrix} H \\ h \\ \phi \end{pmatrix}$$

$$\epsilon_q \simeq \frac{\sin\theta_{2\phi}}{\sin\beta}, \quad \epsilon_\ell \simeq \frac{\sin\theta_{1\phi}}{\cos\beta}.$$

$$\epsilon_W \simeq (\sin\theta_{1\phi}\cos\beta + \sin\theta_{2\phi}\sin\beta)$$

$$\approx \epsilon_\ell \cos^2\beta + \epsilon_q \sin^2\beta \approx \epsilon_q,$$

JL, N. McGinnis, C.E.M. Wagner, X.P. Wang, 2001.06522 (JHEP)

BSM Higgs studies II: Exotic Light Higgs Search

- The Fermion portal to Dark Sector
  - The Interaction: $\lambda\bar{\psi}\phi f_{\rm SM}$
  - Dark Scalars in the Dark Sector
    - Fermion portal — quark/lepton portal
    - f can be quark/lepton, L/R-handed

	DM	SM char	Z_2
ψ	Yes	No	-1
ϕ	No	Yes	-1
$f_{\rm SM}$	No	Yes	1

JL, S. Brian, N. Weiner, I. Yavin, 1303.4404 (JHEP)
Y. Bai, J. Berger, 1308.0612 (JHEP)

- Coupling to specific flavor

$$\mathcal{L} \supset -g_u S\bar{u}u - g_\chi S\overline{\chi}\chi,$$

UV completed by Vector-like Fermions

$$\mathcal{L}_{\rm VLQ} = \mathcal{L}_{\rm SM} + \frac{1}{2}\partial_\mu S\partial^\mu S - \frac{1}{2}m_S^2 S^2 + \overline{U}' i\gamma^\mu D_\mu U' - M\,\overline{U}' U' - [\,y_i\,\overline{Q}_L^i U_R'\,H_c + \lambda^i\,\overline{U}_L' u_{Ri}\,S + \text{h.c.}\,]$$

→ **Higher Dimensional EFT**

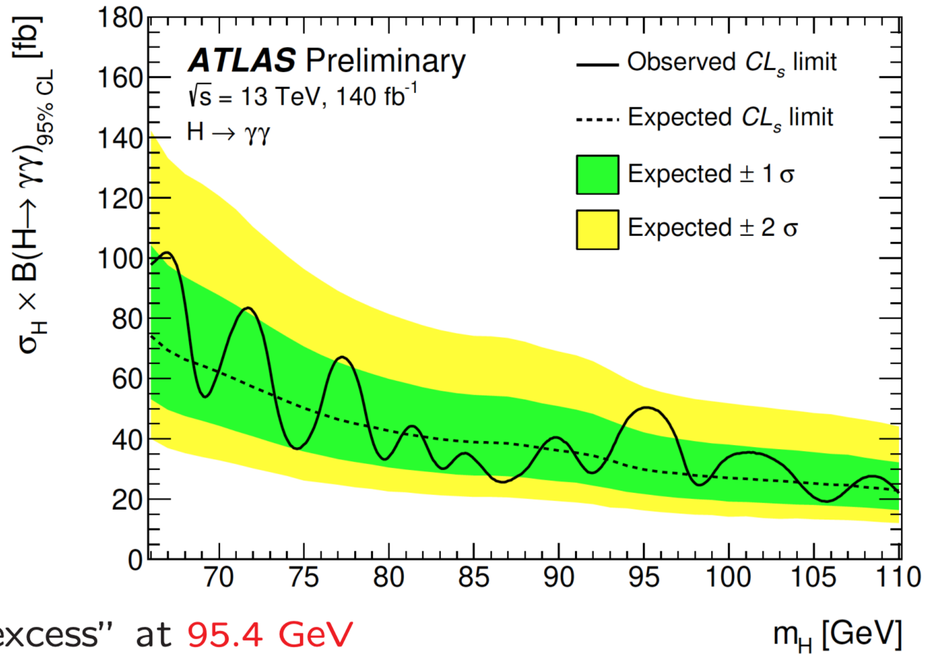
$$\mathcal{L} \supset \frac{y_i\,\lambda^j}{M} S\,\overline{Q}_L^i\,u_{Rj}\,H_c + \text{h.c.}$$

Batell et al, 2107.08059

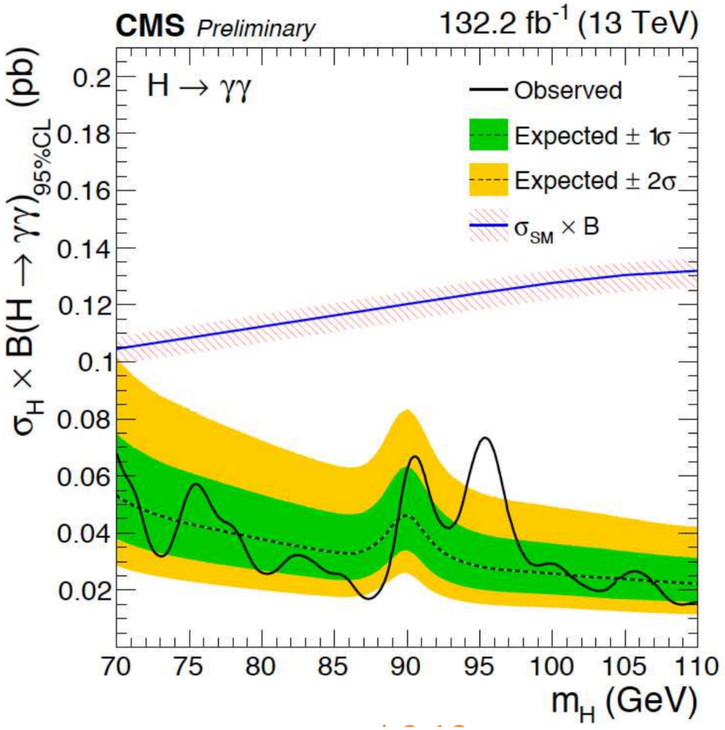
BSM Higgs studies II: Exotic Light Higgs Search

- An interesting interlude from LHC low mass Higgs studies (96 GeV)

New ATLAS result on the low-mass Higgs search in $pp \to \phi \to \gamma\gamma$



⇒ higest "excess" at 95.4 GeV



Courtesy of Sven Heinemeyer, PPC2023

BSM Higgs studies II: Exotic Light Higgs Search

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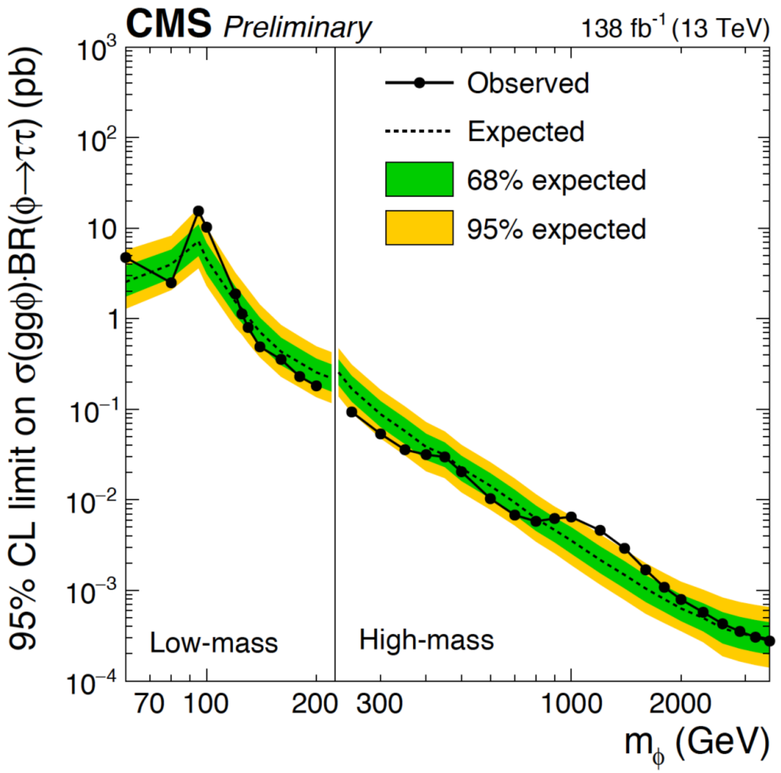
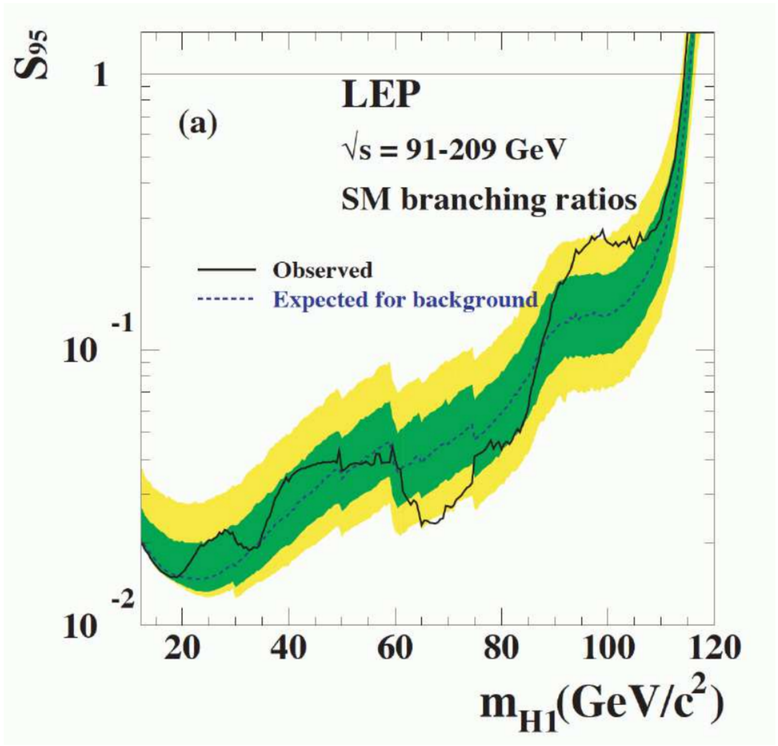
CMS: $pp \to \phi \to \tau^+\tau^-$ $(2.4\,\sigma)$



LEP: $e^+e^- \to Z\phi \to Zb\bar{b}$ $(2\,\sigma)$



- Agreement between ATLAS/CMS (S. Heinemeyer 23'), stay tuned

- See also the talk from Karabo Mosala

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BSM Higgs studies III: DS Scalars at the Z-factory

- Kinetic Mixing Portal: A' should kinetic mixing with Hypercharge field

$$\mathscr{L} = -\frac{1}{4}F'^{\mu\nu}F'^{\mu\nu} + \frac{1}{2}m_{A'}{}^2A'^{\mu}A'\mu - \frac{1}{2}\epsilon F'^{\mu\nu}B^{\mu\nu} + g'A'_{\mu}j^{\mu}_{D}$$

- Z gauge boson is involved (K denotes A')

$$\mathcal{L} \supset \frac{-1}{4}\begin{pmatrix} Z^{\mu\nu}_{\rm SM} & A^{\mu\nu}_{\rm SM} & K^{\mu\nu} \end{pmatrix}\begin{pmatrix} 1 & 0 & \epsilon t_W \\ 0 & 1 & -\epsilon \\ \epsilon t_W & -\epsilon & 1 \end{pmatrix}\begin{pmatrix} Z_{\mu\nu,\,\rm SM} \\ A_{\mu\nu,\,\rm SM} \\ K_{\mu\nu} \end{pmatrix}$$

$$+\frac{1}{2}\begin{pmatrix} Z^{\mu}_{\rm SM} & A^{\mu}_{\rm SM} & K^{\mu} \end{pmatrix}\begin{pmatrix} m^2_{Z,\,\rm SM} & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & m^2_K \end{pmatrix}\begin{pmatrix} Z_{\mu,\,\rm SM} \\ A_{\mu,\,\rm SM} \\ K_{\mu} \end{pmatrix},$$

JL, Xiao-Ping Wang, Felix Yu, 1704.00730 (JHEP)

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- After normalizing kinetic terms and diagonalizing 3x3 mass matrix

$$\begin{aligned}
\mathcal{L} \supset\ & gZ_{\mu,\,\mathrm{SM}}J^{\mu}_{Z} + eA_{\mu,\,\mathrm{SM}}J^{\mu}_{\mathrm{em}} + g_D K_\mu J^{\mu}_{D} \\
&= \tilde{Z}_\mu \left(gJ^{\mu}_{Z} - g_D \frac{m^2_{Z,\,\mathrm{SM}} t_W}{m^2_{Z,\,\mathrm{SM}} - m^2_K}\epsilon J^{\mu}_{D} + g\frac{m^2_{Z,\,\mathrm{SM}}(m^2_{Z,\,\mathrm{SM}} - 2m^2_K)t^2_W}{2(m^2_K - m^2_{Z,\,\mathrm{SM}})^2}\epsilon^2 J^{\mu}_{Z} - e\frac{m^2_{Z,\,\mathrm{SM}} t_W}{m^2_{Z,\,\mathrm{SM}} - m^2_K}\epsilon^2 J^{\mu}_{\mathrm{em}} \right) \\
&+ \tilde{K}_\mu \left(g_D J^{\mu}_{D} + g\frac{m^2_K t_W}{m^2_{Z,\,\mathrm{SM}} - m^2_K}\epsilon J^{\mu}_{Z} + e\epsilon J^{\mu}_{\mathrm{em}} + g_D \frac{(m^4_{Z,\,\mathrm{SM}} c^2_W - 2m^2_K m^2_{Z,\,\mathrm{SM}} + m^4_K)c^{-2}_W}{2(m^2_{Z,\,\mathrm{SM}} - m^2_K)^2}\epsilon^2 J^{\mu}_{D} \right) \\
&+ \tilde{A}_\mu e J^{\mu}_{\mathrm{em}}\,.
\end{aligned}$$

Vanish in the $m_{A'} \ll m_Z$ limit

JL, Xiao-Ping Wang, Felix Yu, 1704.00730 (JHEP)

BSM Higgs studies III: DS Scalars at the Z-factory

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$$\mathscr{L} = -\frac{1}{4}F'^{\mu\nu}F'^{\mu\nu} + \frac{1}{2}m_{A'}{}^2A'^{\mu}A'\mu - \frac{1}{2}\epsilon F'^{\mu\nu}B^{\mu\nu} + g'A'_{\mu}j_D^{\mu}$$

- After normalizing kinetic terms and diagonalizing 3x3 mass matrix

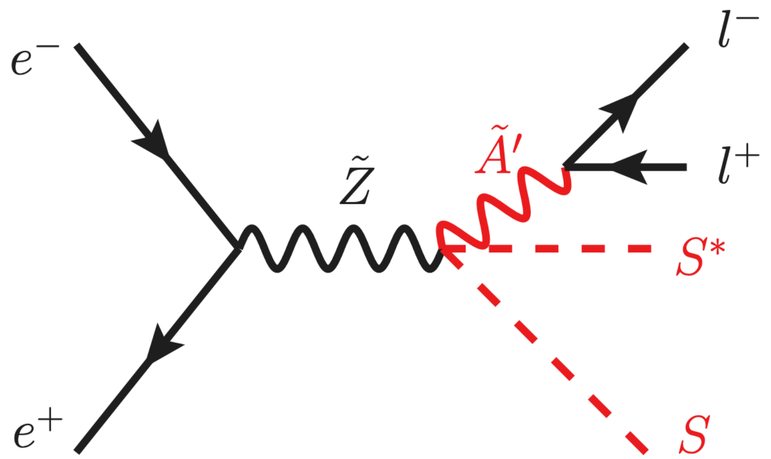
$$\mathcal{L} \supset gZ_{\mu,\,\mathrm{SM}}J_Z^{\mu} + eA_{\mu,\,\mathrm{SM}}J_{\mathrm{em}}^{\mu} + g_D K_{\mu}J_D^{\mu}$$

$$= \tilde{Z}_{\mu}\left(gJ_Z^{\mu} - g_D\frac{m_{Z,\,\mathrm{SM}}^2 t_W}{m_{Z,\,\mathrm{SM}}^2 - m_K^2}\epsilon J_D^{\mu} + g\frac{m_{Z,\,\mathrm{SM}}^2(m_{Z,\,\mathrm{SM}}^2 -\right.$$

$$+ \tilde{K}_{\mu}\left(g_D J_D^{\mu} + g\frac{m_K^2 t_W}{m_{Z,\,\mathrm{SM}}^2 - m_K^2}\epsilon J_Z^{\mu} + e\epsilon J_{\mathrm{em}}^{\mu} + g_D\frac{(m_{Z,\,\mathrm{SI}}^4\right.$$

$$+ \tilde{A}_{\mu}eJ_{\mathrm{em}}^{\mu}\,.$$

Exist but usually overlooked
Could be tested at future Z-factory (e.g. CEPC)



E.g. if dark scalar is contained in the current j_D

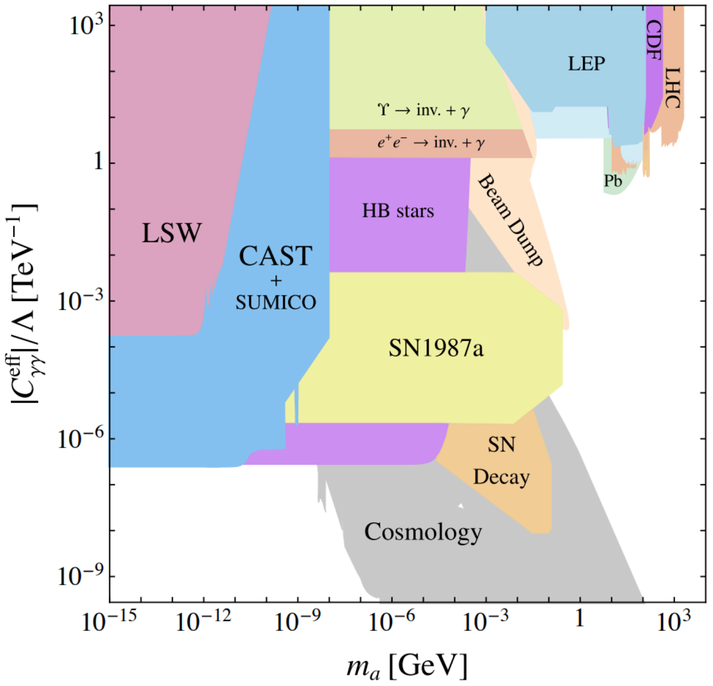
JL, Xiao-Ping Wang, Felix Yu, 1704.00730 (JHEP)

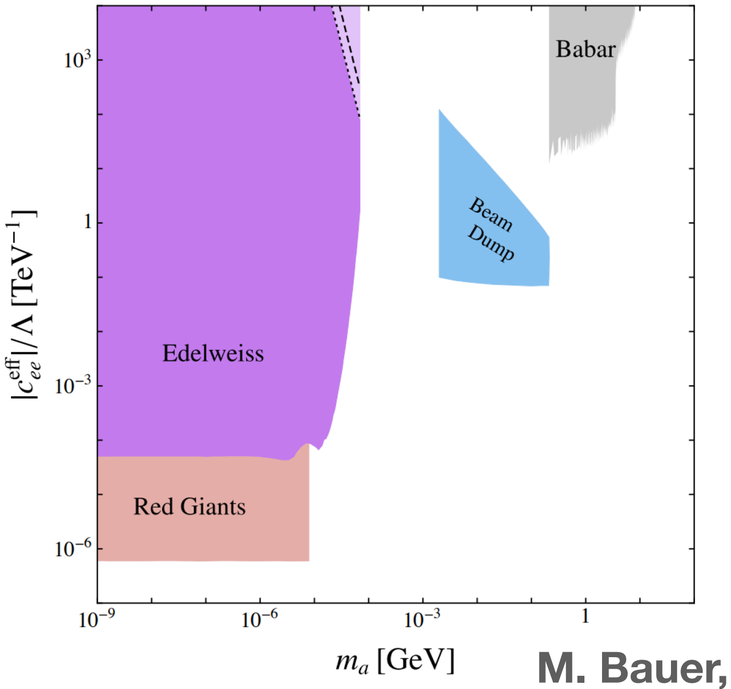
BSM Higgs studies III: DS Pseudo-Scalars at the Z-factory

- The general Axion/ALPs Lagrangian

$$\mathcal{L}_{\text{eff}}^{D\leq 5} = \frac{1}{2}(\partial_\mu a)(\partial^\mu a) - \frac{m_{a,0}^2}{2}a^2 + \frac{\partial^\mu a}{\Lambda}\sum_F \bar{\psi}_F \boldsymbol{C}_F \gamma_\mu \psi_F$$
$$+ g_s^2 C_{GG}\frac{a}{\Lambda}G^A_{\mu\nu}\tilde{G}^{\mu\nu,A} + g^2 C_{WW}\frac{a}{\Lambda}W^A_{\mu\nu}\tilde{W}^{\mu\nu,A} + g'^2 C_{BB}\frac{a}{\Lambda}B_{\mu\nu}\tilde{B}^{\mu\nu}$$

- Motivates searches at colliders and beam dump searches





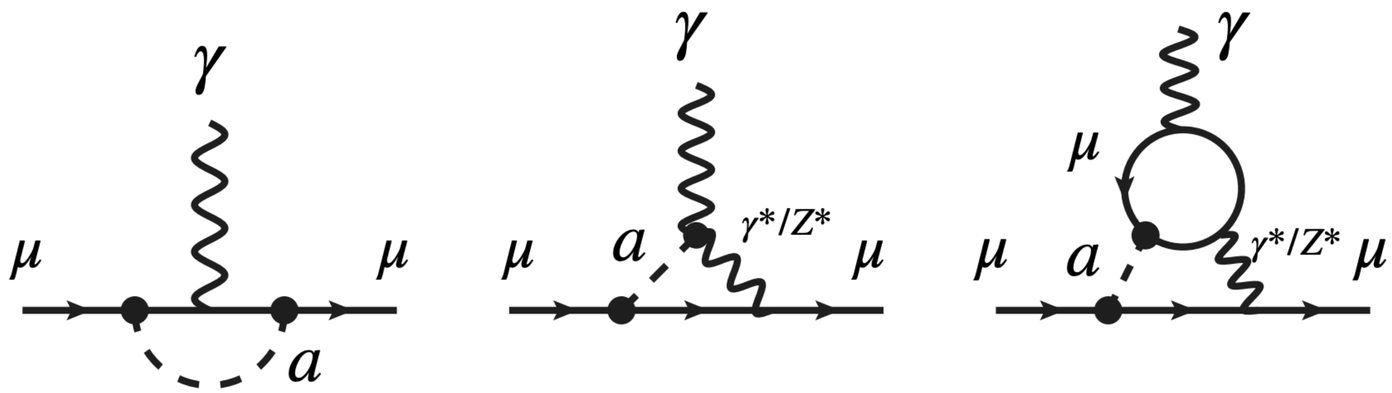
M. Bauer, M. Neubert, A. Thamm, 1708.00443

BSM Higgs studies III: DS Pseudo-Scalars at the Z-factory

- A pseudo-scalar connection to muon g-2

$$\mathcal{L}_{\text{eff}}^{D\leq 5} = \frac{1}{2}(\partial_\mu a)(\partial^\mu a) - \frac{m_{a,0}^2}{2}a^2 + \frac{\partial^\mu a}{\Lambda}\sum_F \bar{\psi}_F \boldsymbol{C}_F \gamma_\mu \psi_F$$
$$+ g_s^2 C_{GG}\frac{a}{\Lambda}G^A_{\mu\nu}\tilde{G}^{\mu\nu,A} + g^2 C_{WW}\frac{a}{\Lambda}W^A_{\mu\nu}\tilde{W}^{\mu\nu,A} + g'^2 C_{BB}\frac{a}{\Lambda}B_{\mu\nu}\tilde{B}^{\mu\nu}$$

- Couplings to muon, Hypercharge field B, and SU(2) W



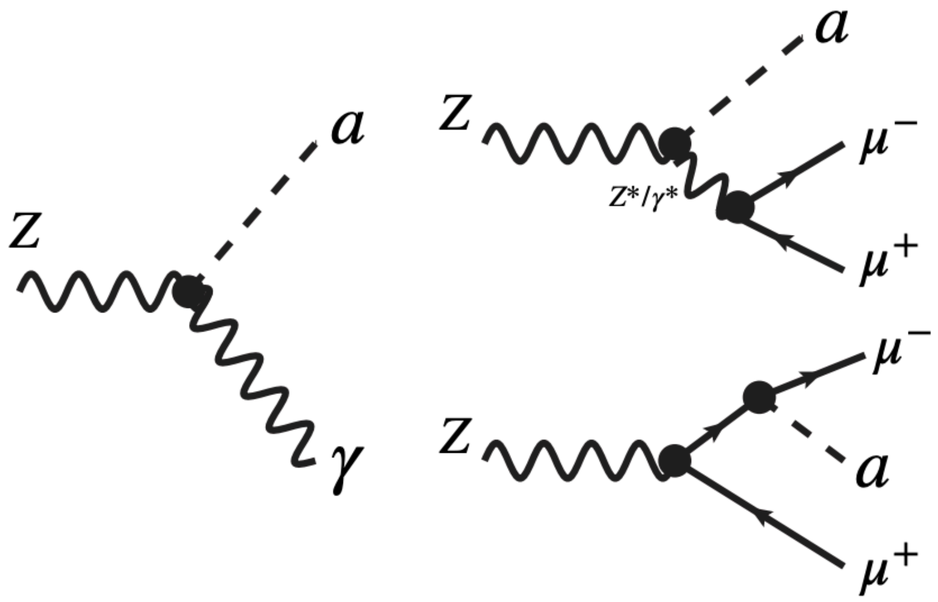
W.Y. Keung et al, hep-ph/0009292
W.J. Marciano et al. 1607.01022
M. Bauer, M. Neubert, A. Thamm, 1708.00443
M. A. Buen-Abad, J. Fan, M. Reece, C. Sun 2104.03267
JL, X. Ma, L.T. Wang, W.P. Wang 2210.09335 (PRD)

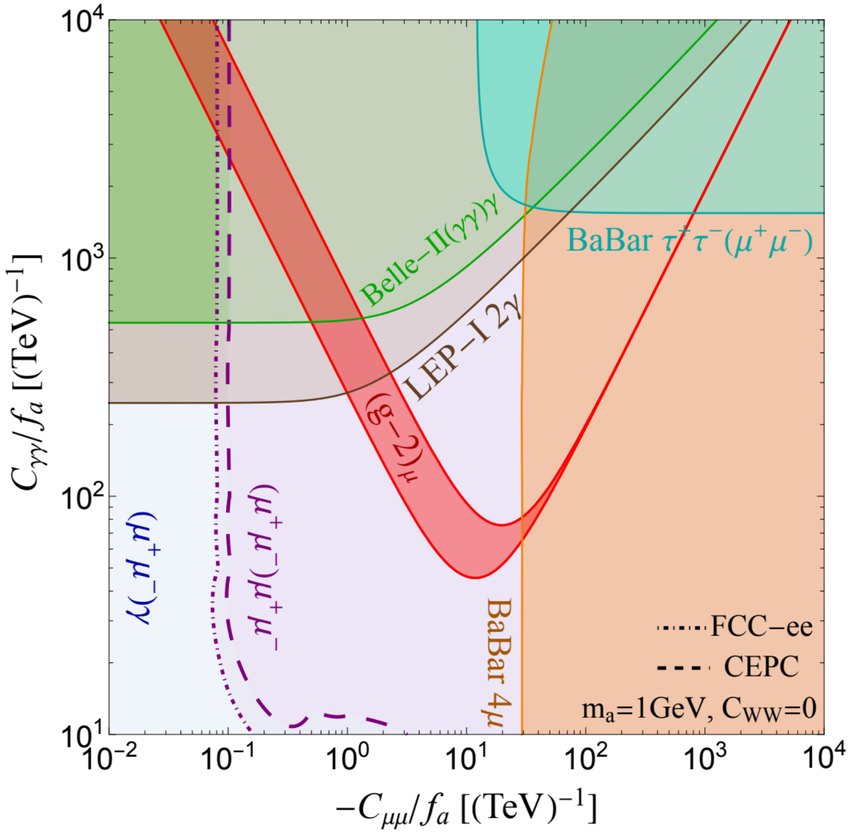
BSM Higgs studies III: DS Pseudo-Scalars at the Z-factory

- A pseudo-scalar connection to muon g-2 and future Z-factory

$$\mathcal{L}_{\text{eff}}^{D\leq 5} = \frac{1}{2}(\partial_\mu a)(\partial^\mu a) - \frac{m_{a,0}^2}{2}a^2 + \frac{\partial^\mu a}{\Lambda}\sum_F \bar{\psi}_F \boldsymbol{C}_F \gamma_\mu \psi_F$$
$$+ g_s^2 C_{GG}\frac{a}{\Lambda}G^A_{\mu\nu}\tilde{G}^{\mu\nu,A} + g^2 C_{WW}\frac{a}{\Lambda}W^A_{\mu\nu}\tilde{W}^{\mu\nu,A} + g'^2 C_{BB}\frac{a}{\Lambda}B_{\mu\nu}\tilde{B}^{\mu\nu}$$

- Z exotic decays

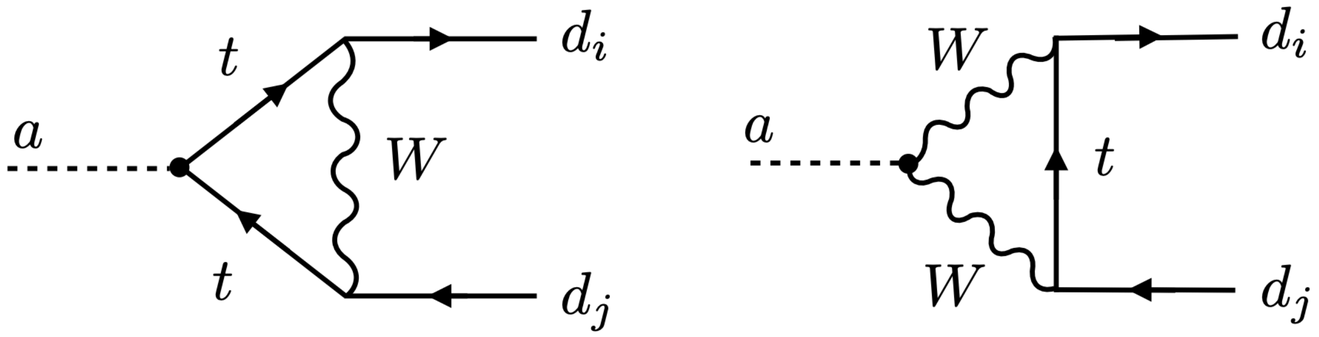




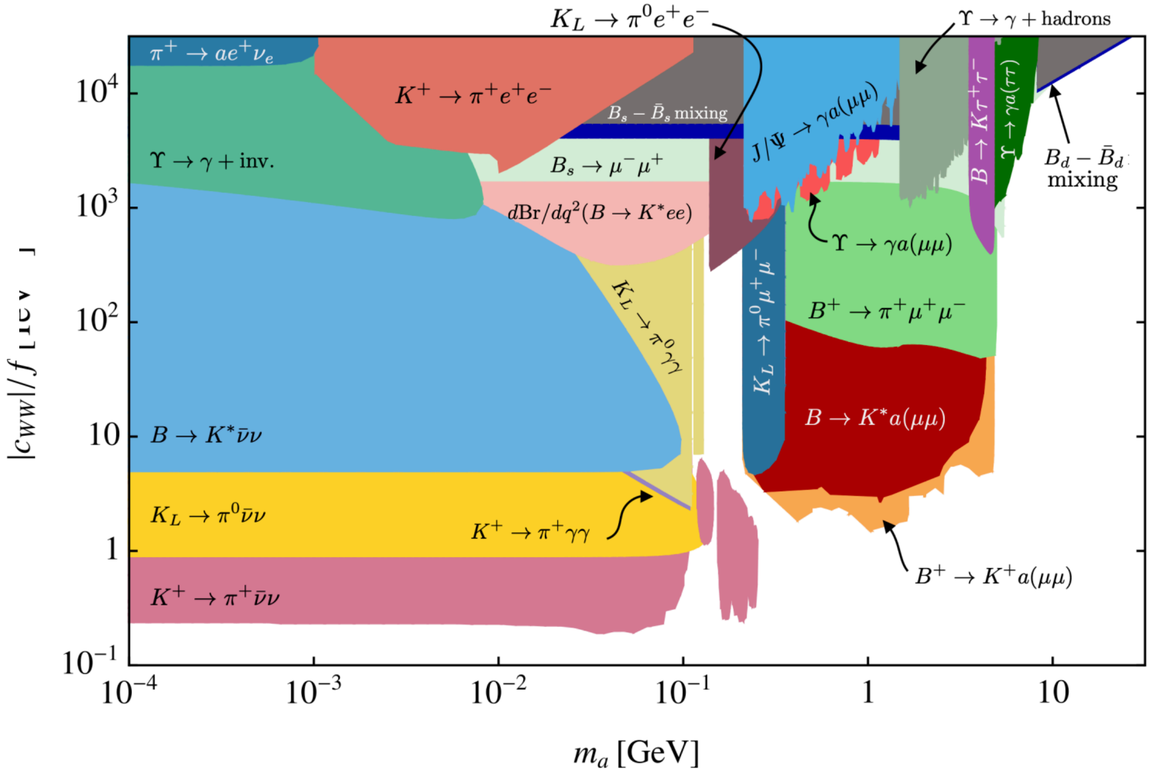
JL, X. Ma, L.T. Wang, W.P. Wang 2210.09335 (PRD)

BSM Higgs studies III: DS Pseudo-Scalars at CEPC

- The general Lagrangian (usually people consider flavor diagonal)
- However, if starting from high energy, it will end up with flavor off-diagonal interactions at low energy: $\mathbf{C}_F \to \mathbf{C}_F^{ij}$



- Providing ALP motivations to Flavor Searches at low energy, e.g. BES-III, Belle-II, STCF
- For CEPC, new opportunities on Charged Lepton Flavor Violation



M. Bauer, M. Neubert, S. Renner, M. Schnubel, A. Thamm, 2110.10698

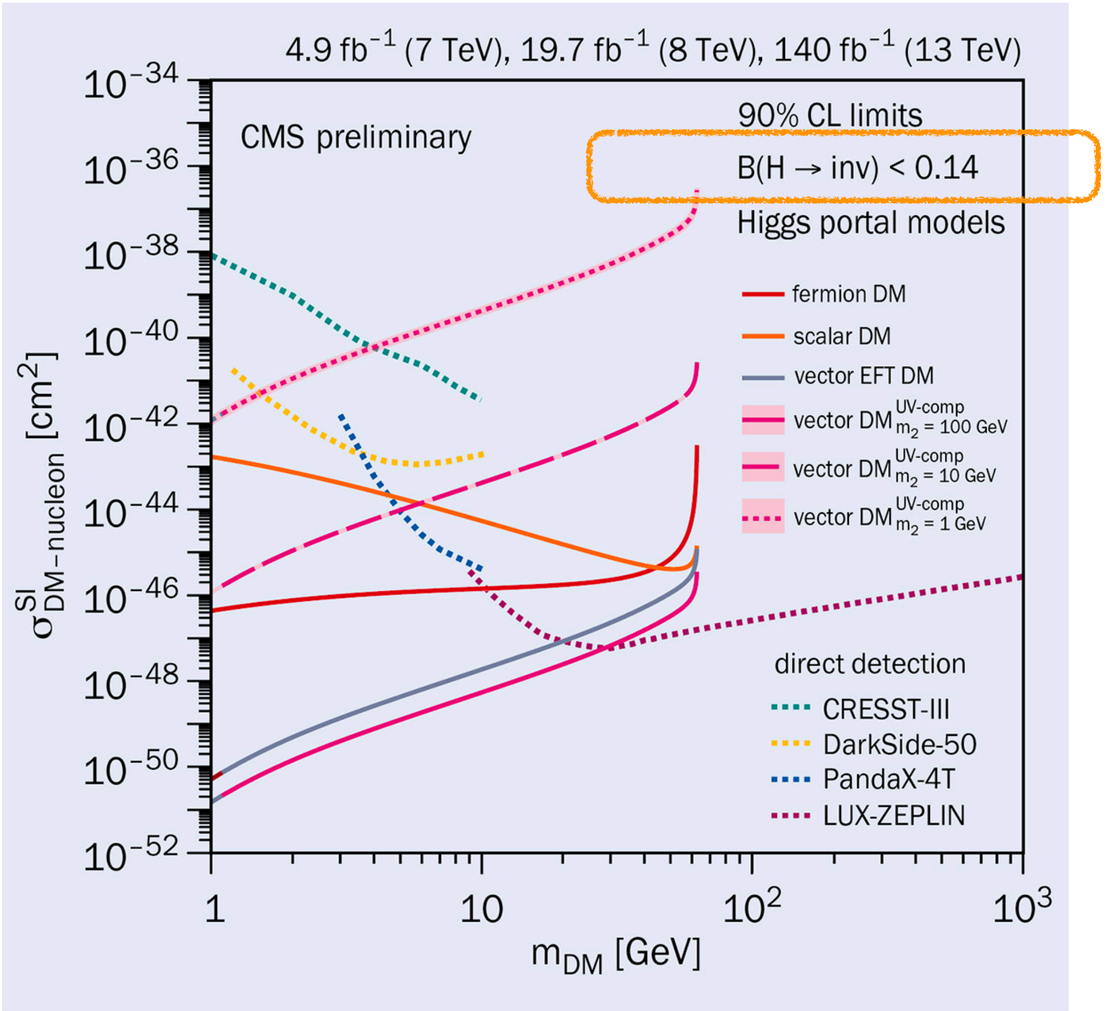
Outline

- Introduction
- BSM Higgs studies
  - Higgs Exotic Decay
  - Exotic Light Higgs Searches
  - Dark Sector scalars or pseudo-scalars at Z-Factory
  - Higgs invisible decay for Higgs Portal Dark Matter
- Summary

BSM Higgs studies IV: Invisible Higgs Decay

- Precision measurement for BSM Higgs
  - Invisible Higgs test to 0.07%@CEPC

	240 GeV, 20 ab^{-1}		360 GeV, 1 ab^{-1}		
	ZH	**vvH**	ZH	**vvH**	**eeH**
inclusive	**0.26%**		**1.40%**	\	\
H→bb	**0.14%**	**1.59%**	**0.90%**	**1.10%**	**4.30%**
H→cc	**2.02%**		**8.80%**	**16%**	**20%**
H→gg	**0.81%**		**3.40%**	**4.50%**	**12%**
H→WW	**0.53%**		**2.80%**	**4.40%**	**6.50%**
H→ZZ	**4.17%**		**20%**	**21%**	
$H \to \tau\tau$	**0.42%**		**2.10%**	**4.20%**	**7.50%**
$H \to \gamma\gamma$	**3.02%**		**11%**	**16%**	
$H \to \mu\mu$	**6.36%**		**41%**	**57%**	
$H \to Z\gamma$	**8.50%**		**35%**		
$\mathrm{Br}_{upper}(H \to inv.)$	**0.07%**				
Γ_H	**1.65%**		**1.10%**		



Summary

- Future ee collider (CEPC/FCC-ee etc) provides valuable opportunities to test Standard Model and Beyond the SM physics
- BSM Higgs searches benefits from the high precision and unique environment of CEPC
  - Exotic Higgs decay at CEPC can benefit from “recoil mass” technique
  - Exotic Light Higgs Searches should be carried out at CEPC
  - Dark Sector scalars or pseudo-scalars related with Z boson can be tested at Z-Factory
  - Higgs invisible decay is a crucial test for Higgs Portaled Dark Matter
- CEPC offers a diverse and extensive research program covering various aspects for BSM Higgs

Thank you!

Backup slides