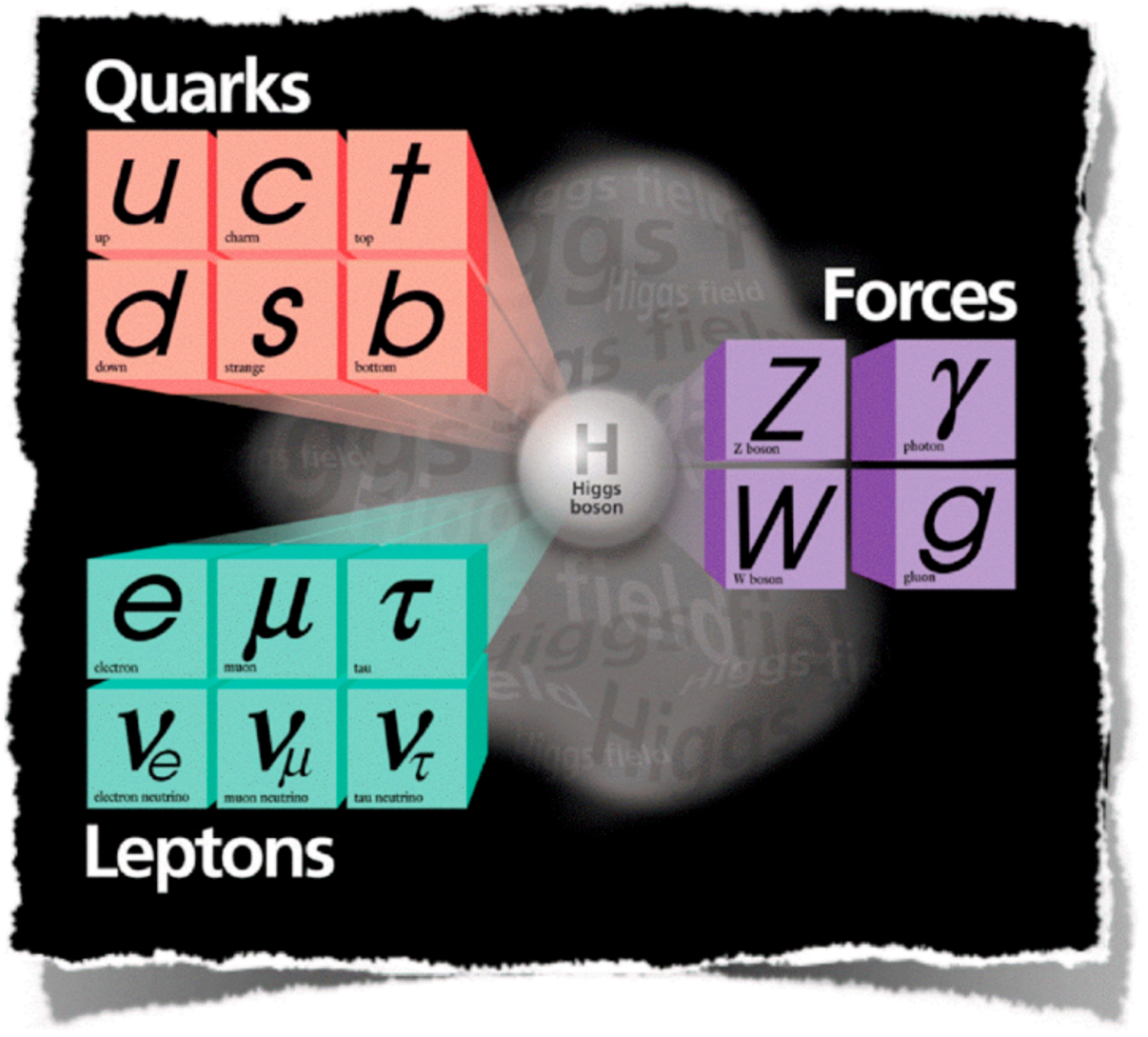
The Colorful Life of Tao in the Colorless Higgs Branch

Shufang Su • Dept of Physics

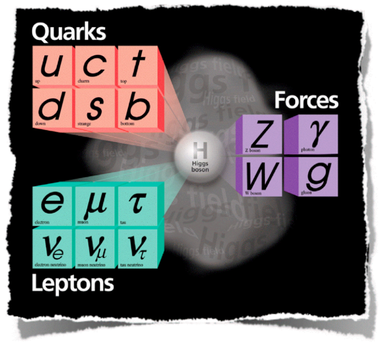
May 14, 2026

Tao Fest

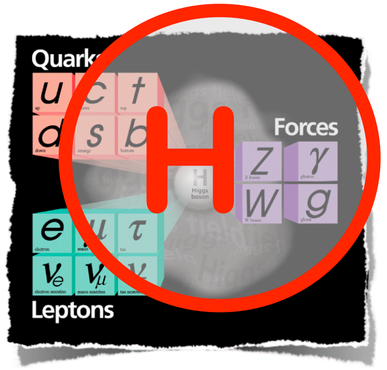
Physics

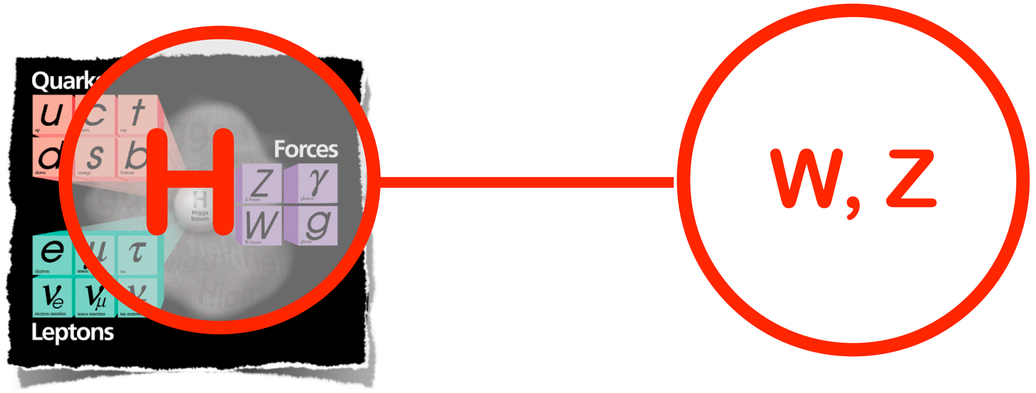

Quarks
u
up
c
charm
t
top
d
down
s
strange
b
bottom
Forces
Z
Z boson
γ
photon
W
W boson
g
gluon
H
Higgs boson
e
electron
μ
muon
τ
tau
νe
electron neutrino
νμ
muon neutrino
ντ
tau neutrino
Leptons

Physics



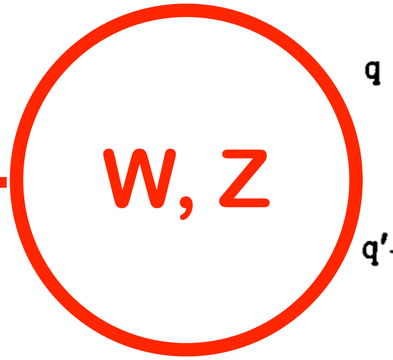
Physics

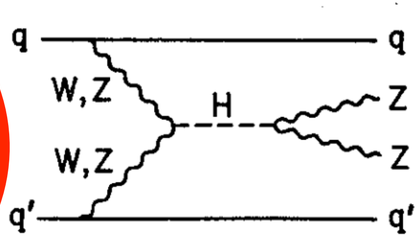

Quark
u c t
d s b
Forces
Z γ
W g
H
e μ τ
Leptons

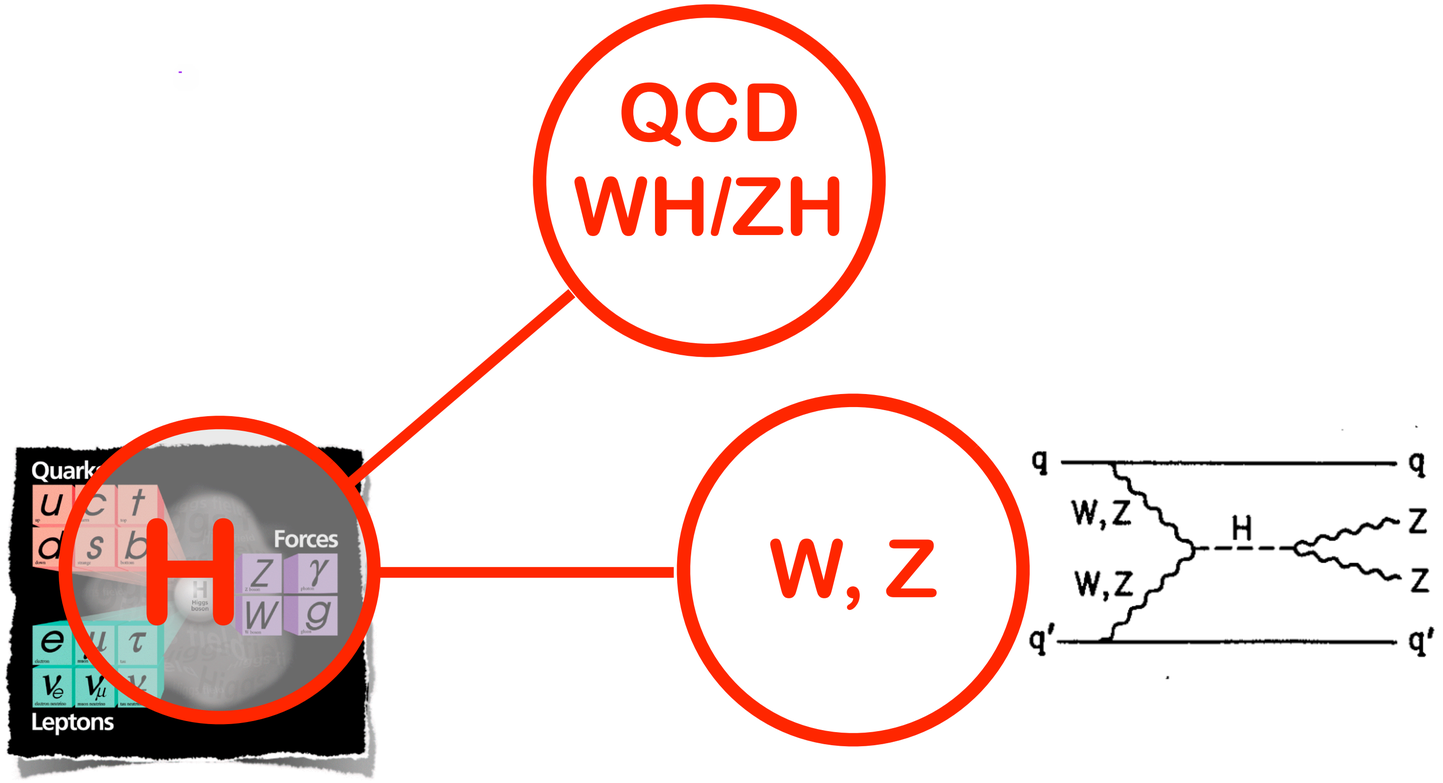


Physics

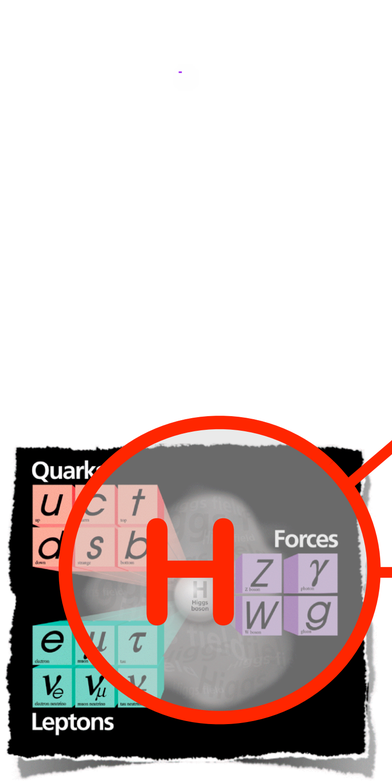

Quark
u c t
d s b
Forces
Z γ
W g
e μ τ
Leptons
H


W, Z

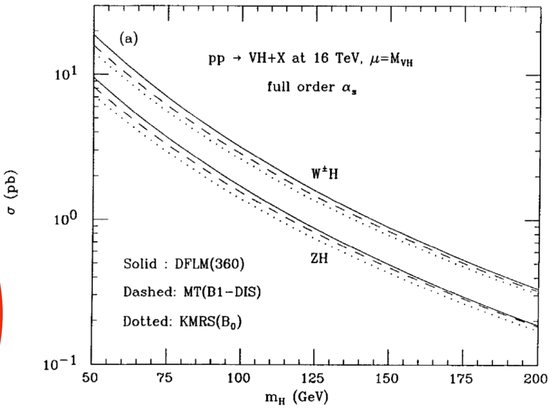

q
q
W,Z
H
Z
W,Z
Z
q'
q'



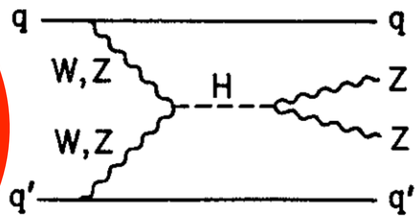
Physics



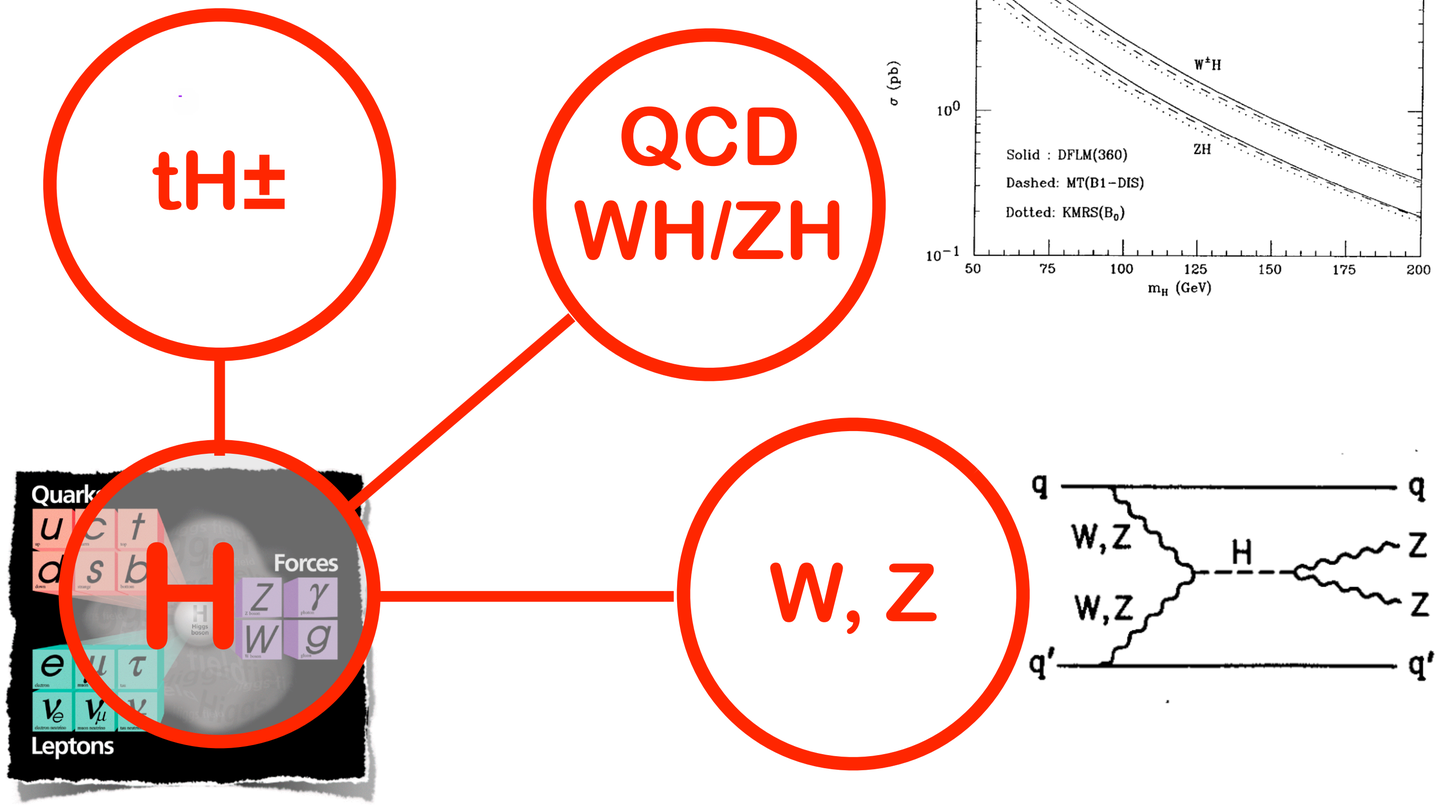
QCD WH/ZH



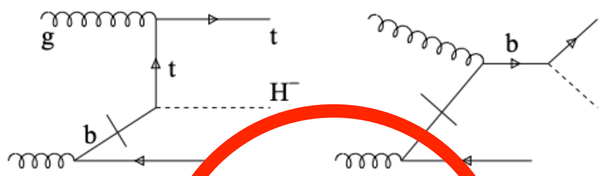
W, Z



Physics

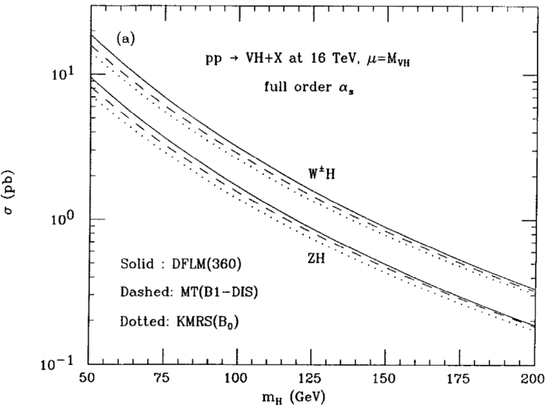

tH±
QCD
WH/ZH
W, Z
H
Quarks
Forces
Leptons
(a)
pp → VH+X at 16 TeV, μ=M_VH
full order α_s
W±H
ZH
Solid : DFLM(360)
Dashed: MT(B1-DIS)
Dotted: KMRS(B0)
σ (pb)
m_H (GeV)
q
q
W,Z
H
Z
W,Z
Z
q'
q'

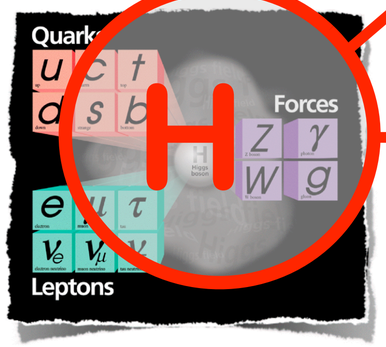
Physics



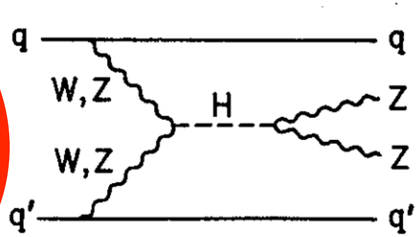
tH±

QCD WH/ZH

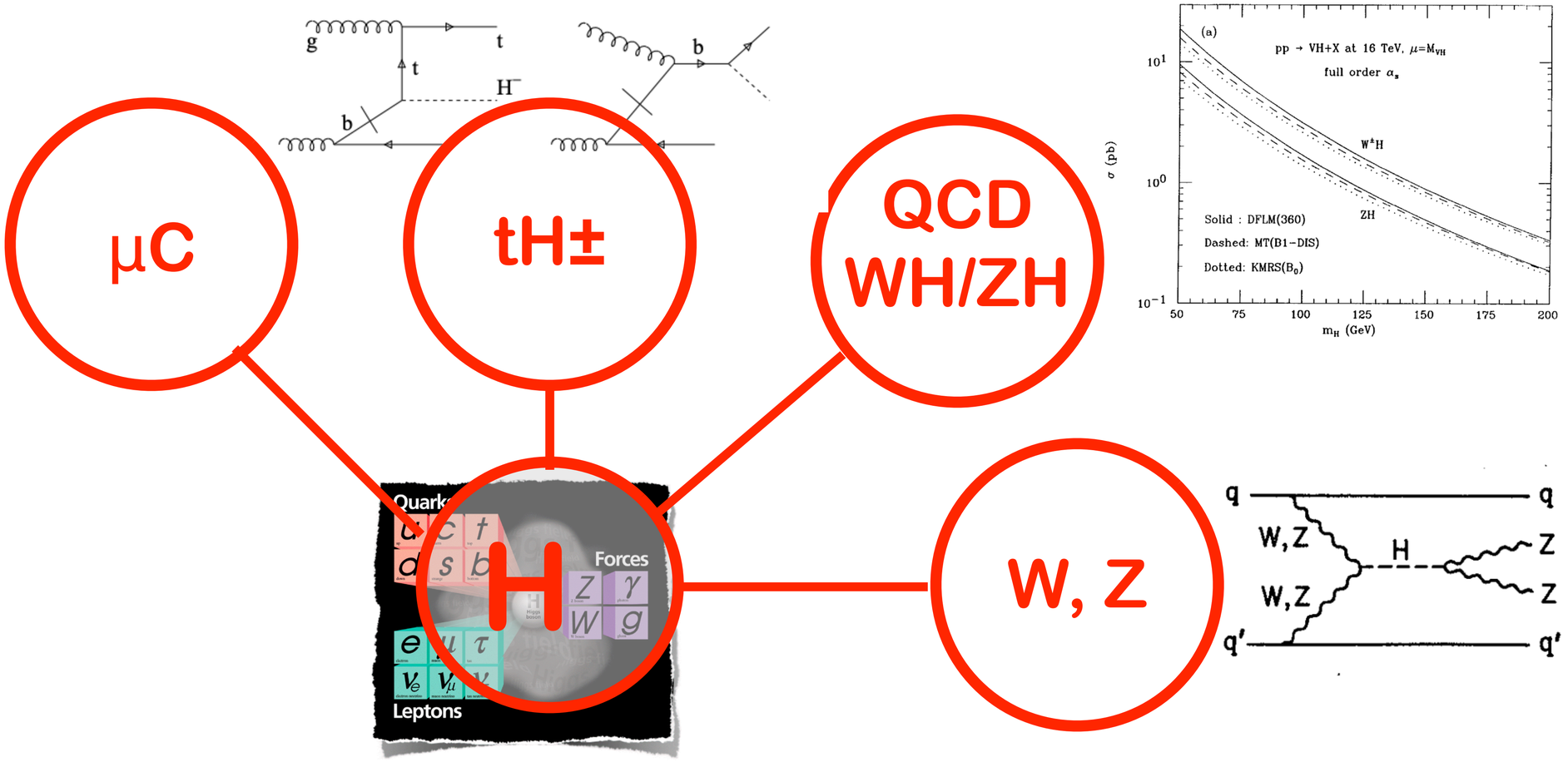




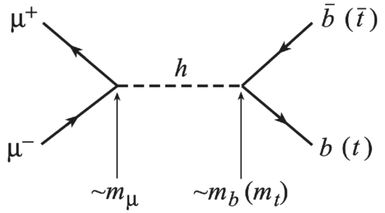
W, Z

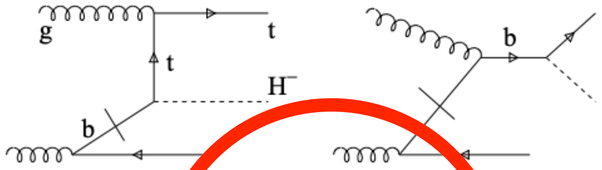


Physics


μC
tH±
QCD
WH/ZH
W, Z
H
Quarks
Forces
Leptons
g
t
t
H⁻
b
b
(a)
pp → VH+X at 16 TeV, μ=M_VH
full order α_s
W±H
ZH
Solid : DFLM(360)
Dashed: MT(B1-DIS)
Dotted: KMRS(B0)
σ (pb)
m_H (GeV)
q
q
W,Z
H
Z
W,Z
Z
q'
q'

Physics

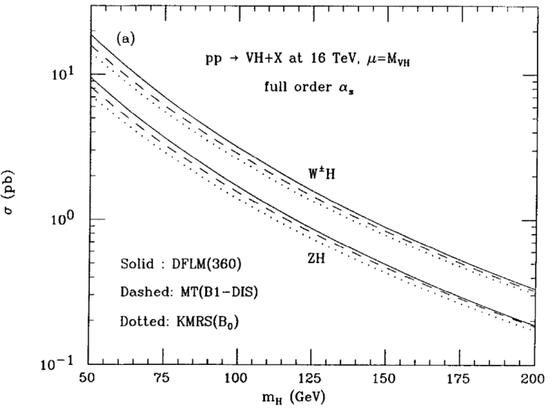


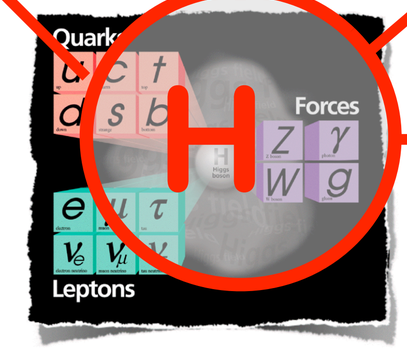


μC

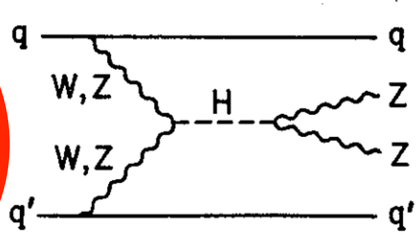
tH±

QCD
WH/ZH

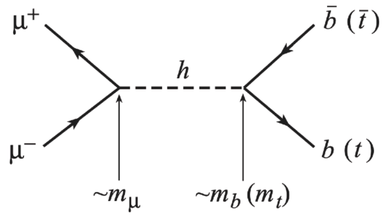


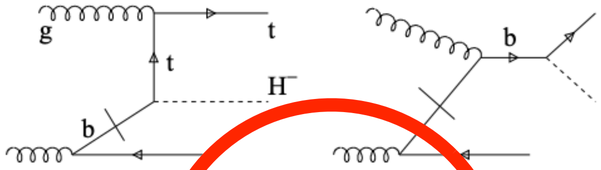


W, Z



Physics





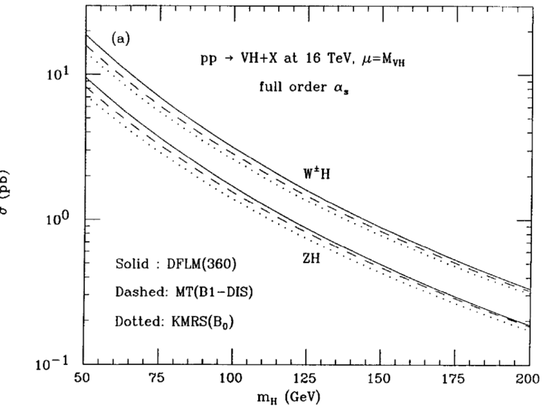
μC

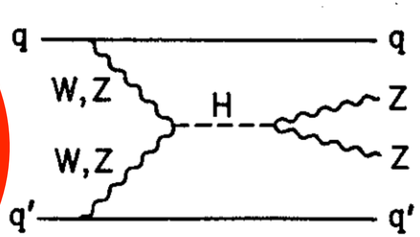
tH±

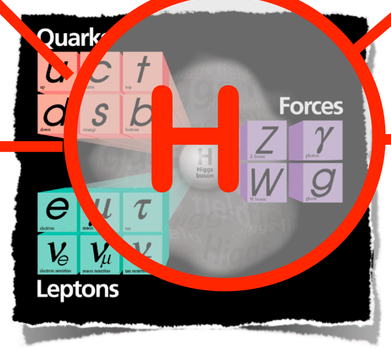
QCD WH/ZH

Higgs factory

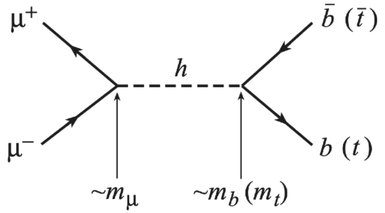
W, Z

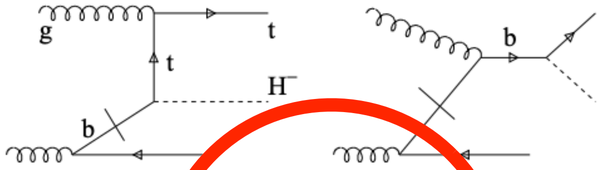


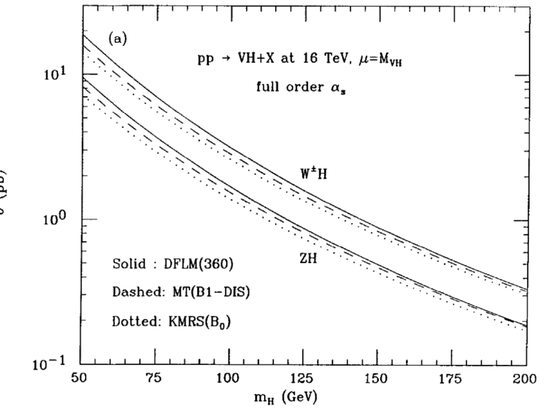


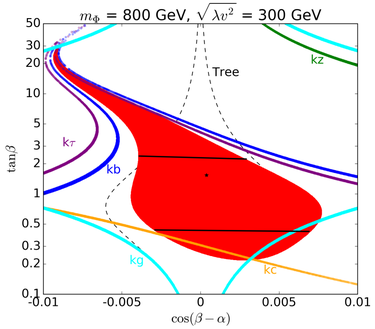


Physics







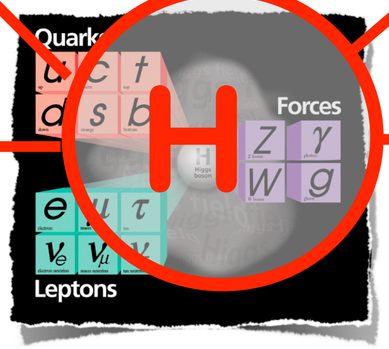


μC

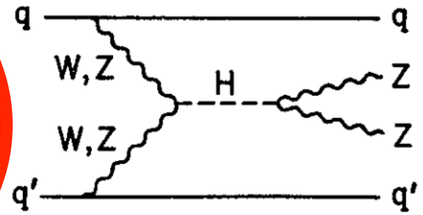
tH±

QCD WH/ZH

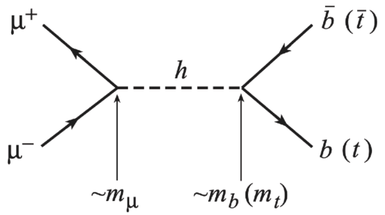
Higgs factory

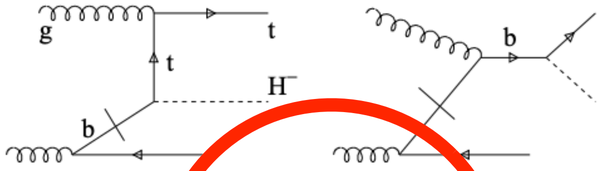


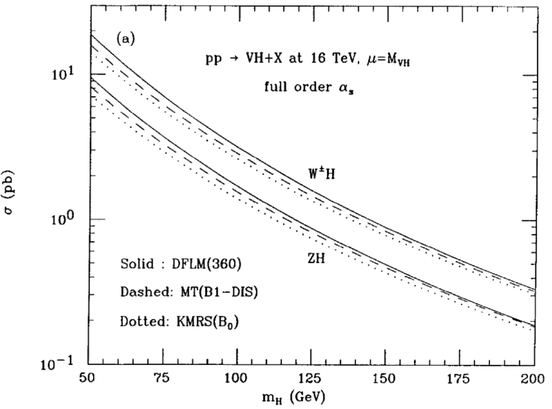
W, Z



Physics



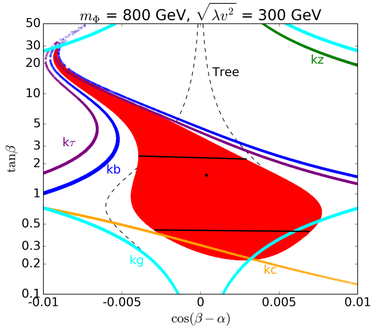




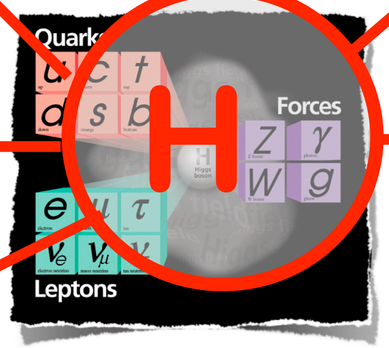
μC

tH±

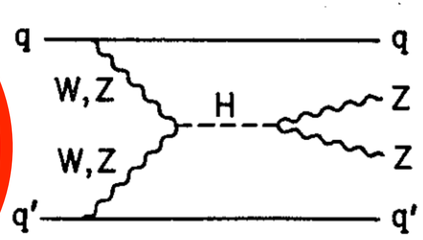
QCD WH/ZH



Higgs factory

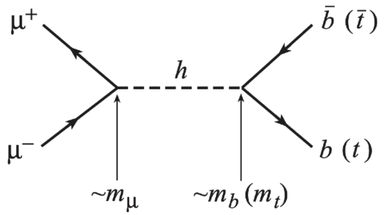


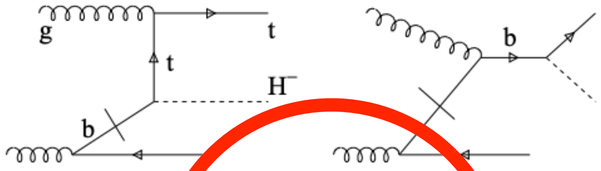
W, Z

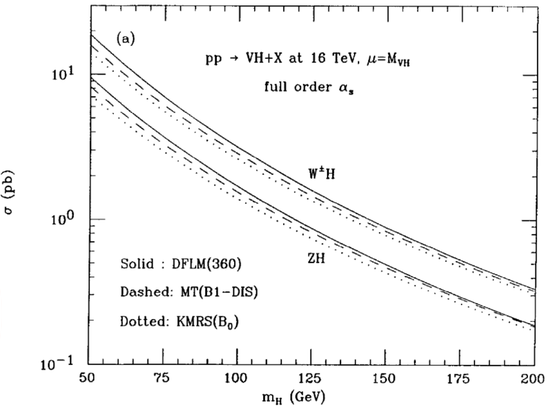


MSSM

Physics



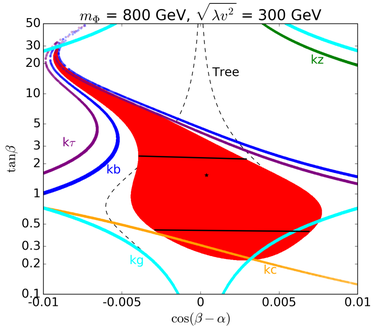




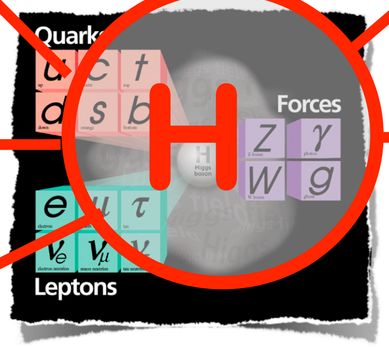
μC

tH±

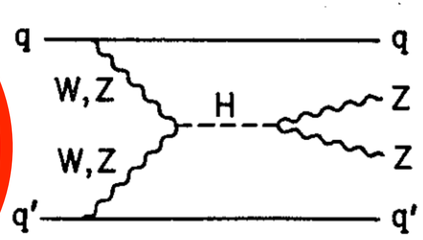
QCD WH/ZH



Higgs factory



W, Z



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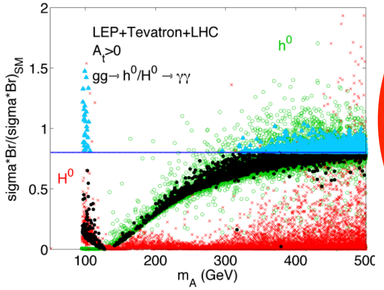
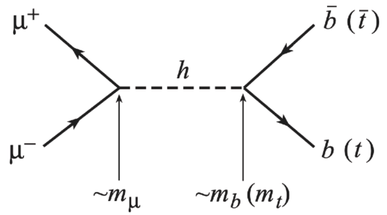
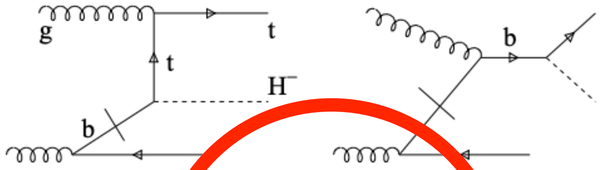
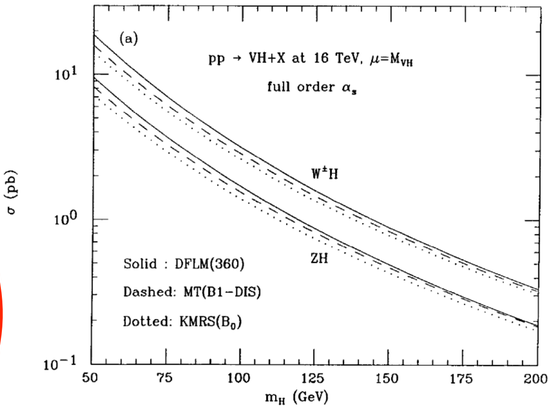


Physics



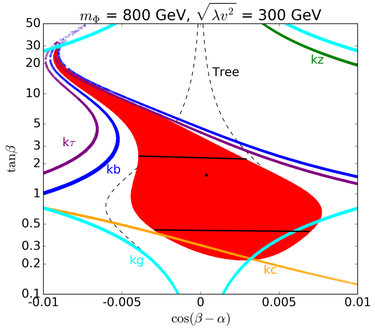




μC

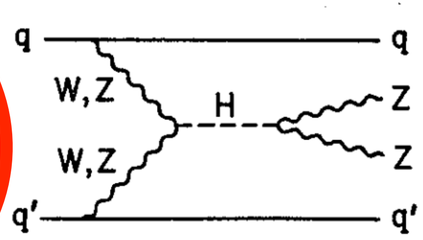
tH±

QCD WH/ZH



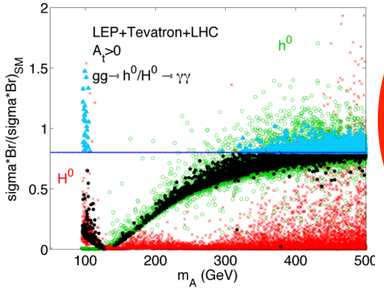
Higgs factory

W, Z

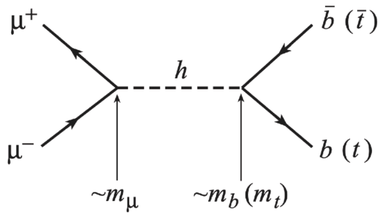


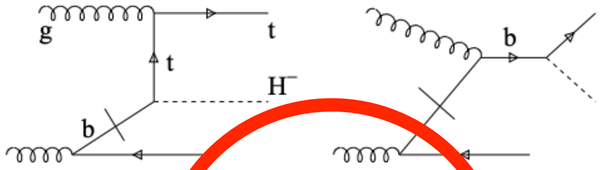
MSSM

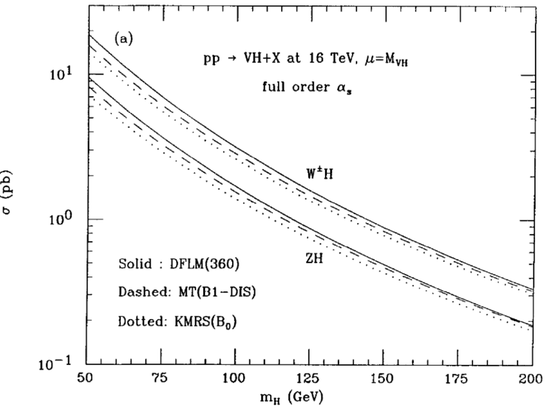
Electro-weakino



Physics



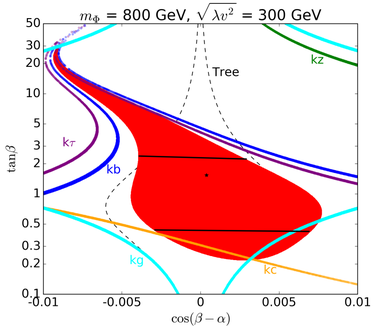




μC

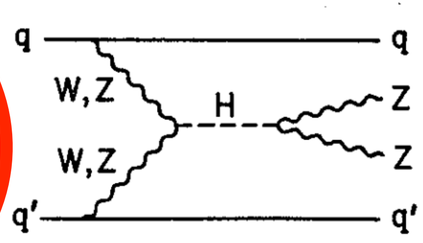
tH±

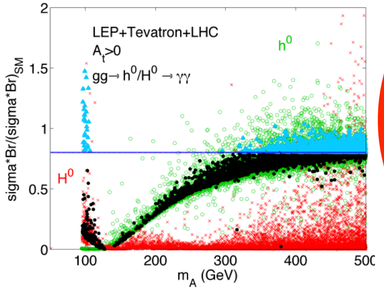
QCD WH/ZH



Higgs factory

W, Z



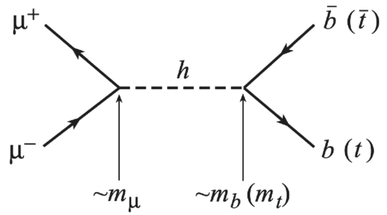


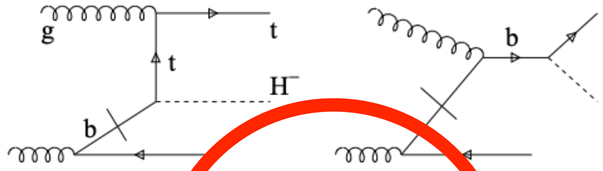
MSSM

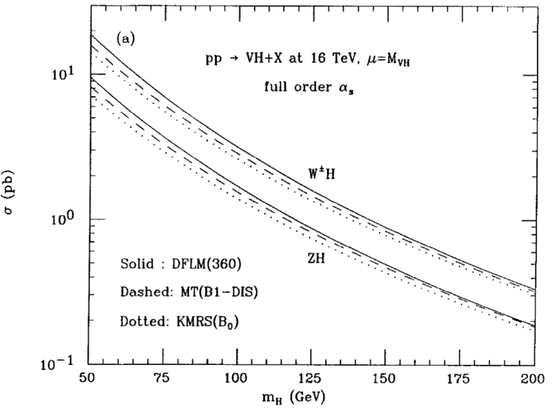
Electro-weakino

little H

Physics



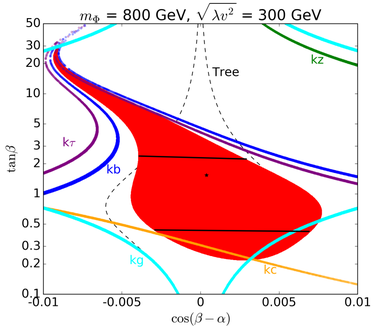




μC

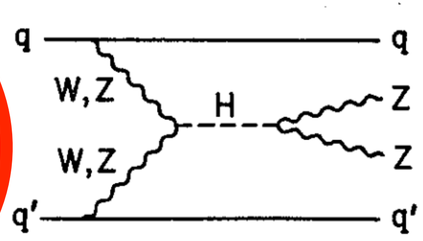
tH±

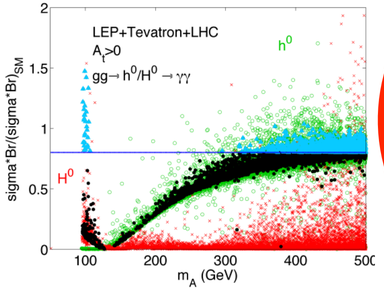
QCD WH/ZH



Higgs factory

W, Z





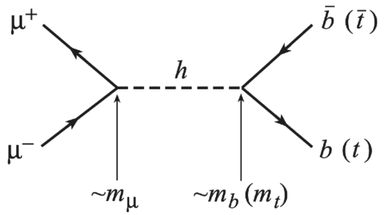
MSSM

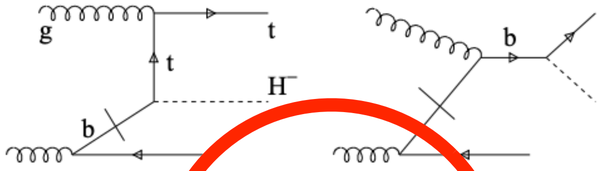
Electro-weakino

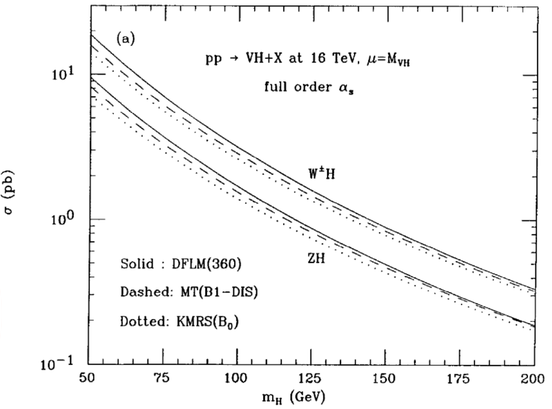
little H

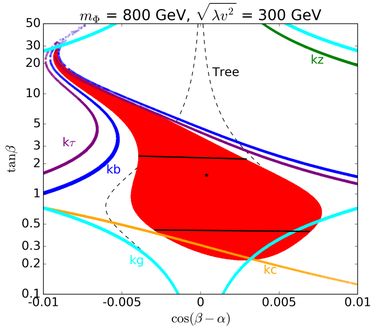
Type-II Seesaw

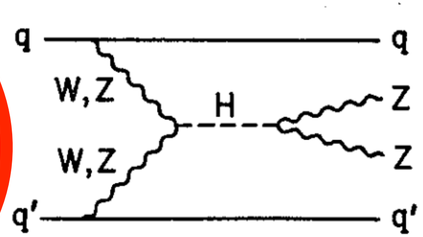
Physics

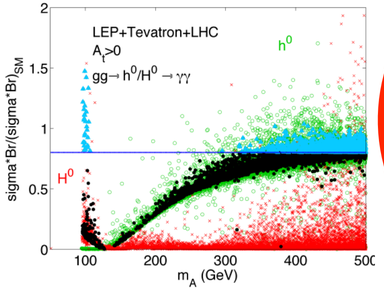


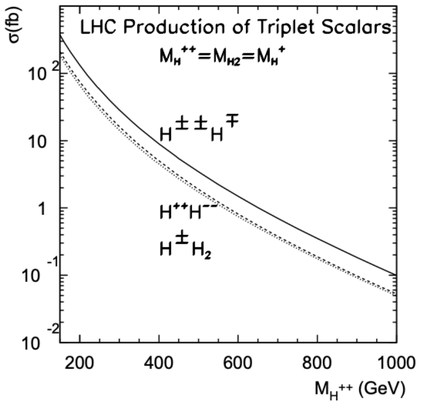












μC

tH±

QCD WH/ZH

Higgs factory

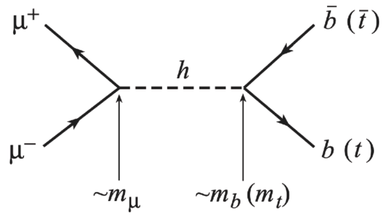
W, Z

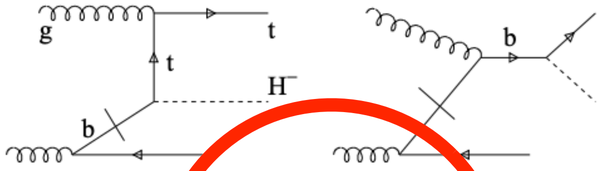
MSSM

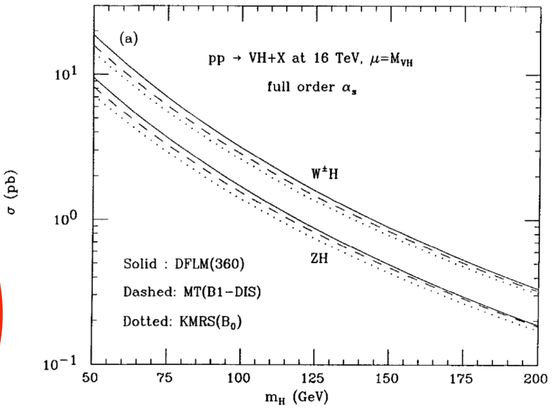
Electro-weakino

little H

Type-II Seesaw



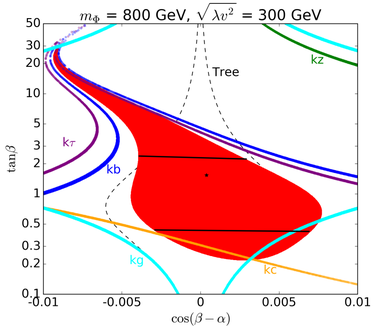




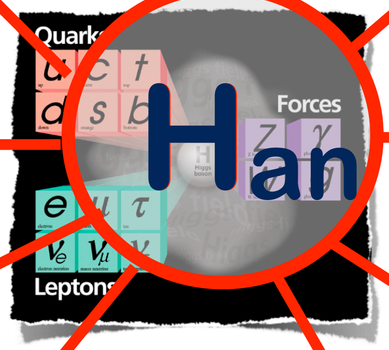
μC

tH±

QCD WH/ZH

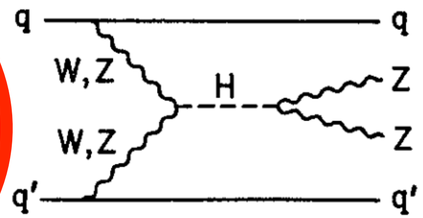


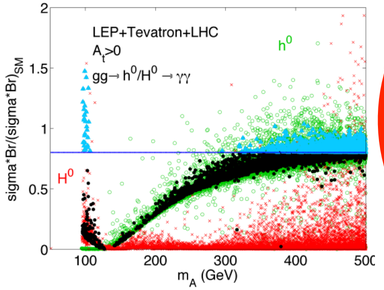
Higgs factory



Han

W, Z



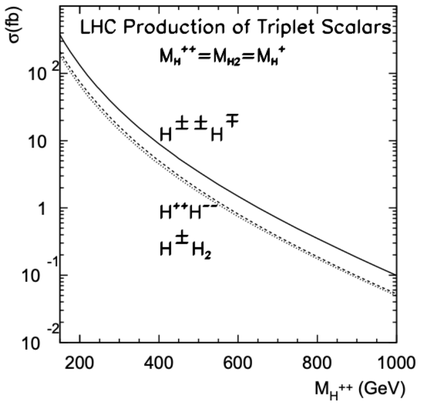


MSSM

Electro-weakino

little H

Type-II Seesaw



SU(3) X SU(2) X U(1)

Physics

Extra D

SU(3) X SU(2) X U(1)

Physics

Extra D

Dark Sector

SU(3) X SU(2) X U(1)

Physics

Extra D

Dark Sector

SU(3) X SU(2) X U(1)

Quantum domain

Physics

Higgs

- Spin 0 Boson
- Mass unprotected from quantum fluctuations
- Interact with many
- Develops a VeV, provide mass to other particles
- SM not complete without Higgs

Han

- Never alone → Boson
- Unprotected from drink fluctuations
- Interact with many
- …
- Pheno world not complete without Han

Physics

2008

KITPC 2008 Program: New Physics beyond the SM

A. KITPC BSM SUMMER ACTIVITY (June 30 - July 25)

July 2 Chair: Hongjian He

9:30 - 10:30 Sekhar Chivukular: Three-Site Higgsless Model

10:45 - 11:45 Elizabeth Simmons: Hypercharge-Universal Topcolor

14:30 Discussion lead by Chivukular and Simmons

BSM Week (July 14 - 18)

July 14 (Monday) Chairman: Shufang Su

9:30 - 11:00 Carlos Wagner, Supersymmetric Origin of Matter

14:30 Discussion lead by Carlos Wagner

July 15 (Tuesday) Chairman: R. Sekhar Chivukula

10:00 - 11:00 Antonio Delgado, discussion on unparticle physics

15:00 - 16:30 Jon Shock, Holographic Spectral Functions at Finite Baryon Density

July 16 (Wednesday) Chairman: Hong-jian He

9:30 - 11:00 Marcela S Carena-Lopez, Interplay of B and Higgs Physics in the MSSM

14:30 Discussion lead by Marcela Carena

July 17 (Thursday) Chairman: Shou-hua Zhu

9:30 - 11:00 Antonio Delgado, Phenomenology of Randall-Sundrum scenario

14:30 Discussion lead by Antonio Delgado

New Physics Beyond the Standard Model

Sep 1 - Nov 21 , 2008

KITPC/ITP - CAS

International Coordinators: Sekhar Chivukular, Tao Han, Yuping Kuang, Gordy Kane, Shufang Su

Local Coordinators: Hongjian He, zuotang Liang, Minxin Luo, Zongguo Si, Jinmin Yang, Shouhua Zhu

Physics

2012

SUSY 2012, Beijing

The 20th International Conference on Supersymmetry and the Unification of Fundamental Interactions (SUSY 2012)

August13−18,2012
Peking University,Beijing,China

Physics

2013

Center for Future High Energy Physics, IHEP

2013+

CEPC - SPPC

2016 CEPC-SPPC Study Group Meeting

2016.09.02-03

Physics

My work with Tao

h_{an}-index 12

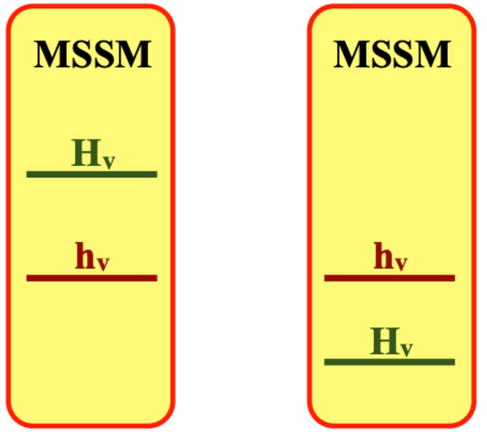
Collaborators

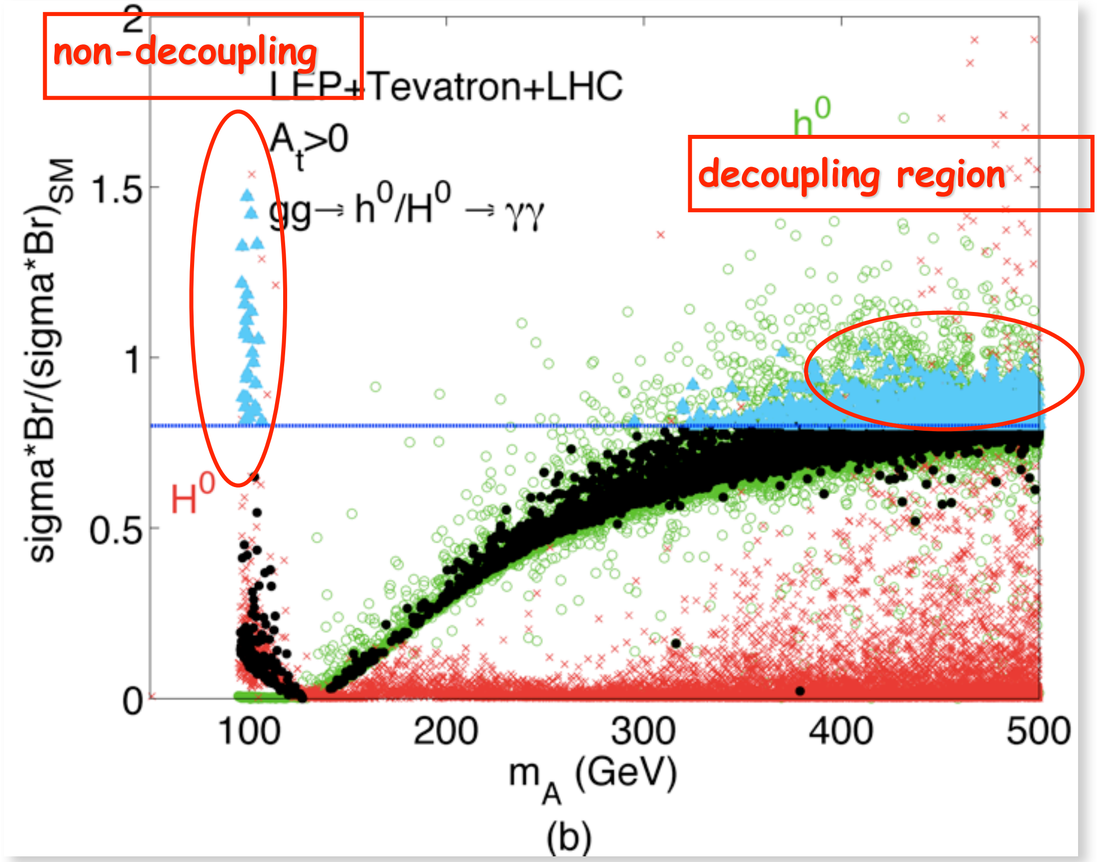
Vernon D. Barger	49
Shufang Su	12
John F. Gunion	11
Kingman Cheung	11
Matthew Low	11
Zhen Liu	11
Dieter Zeppenfeld	11
Xing Wang	10
Ren-Jie Zhang	9
Lian-Tao Wang	9

Physics

2012

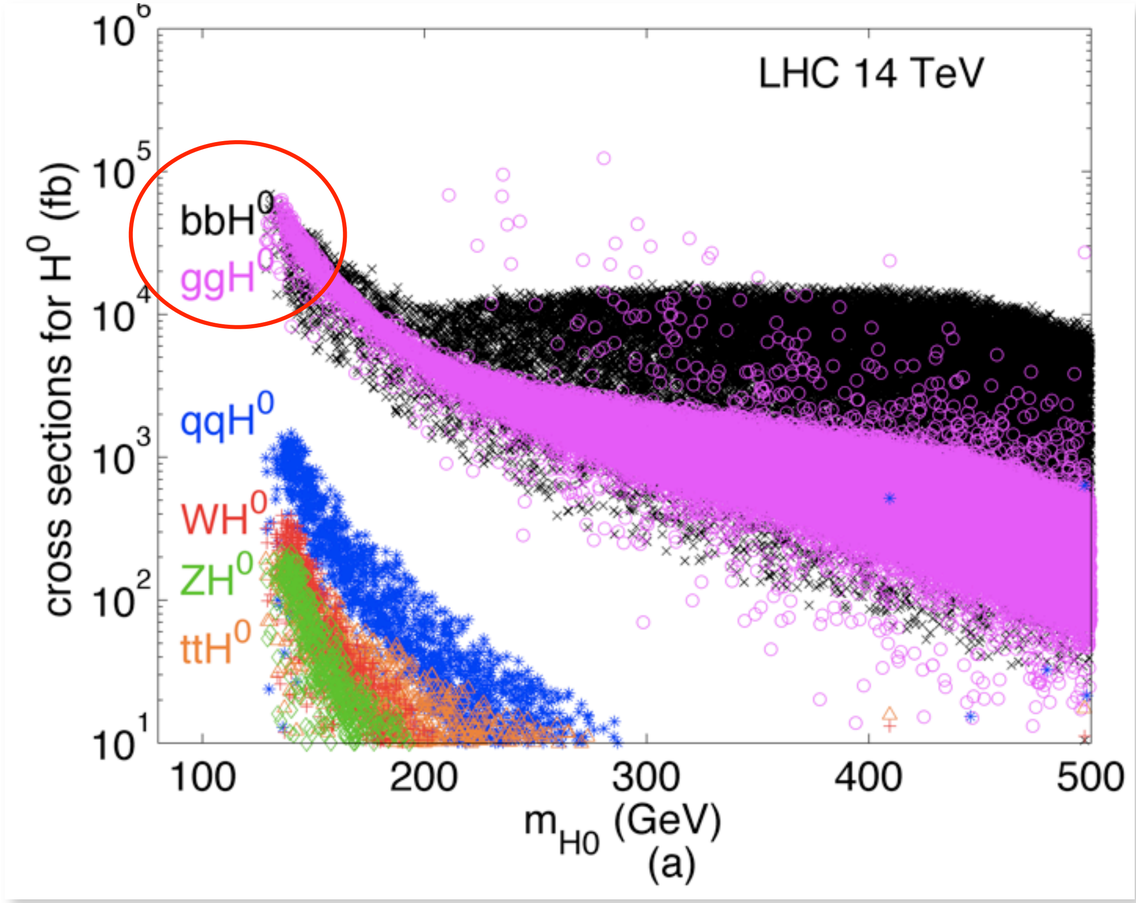
MSSM Higgs Bosons at the LHC, Christensen, Han, SS





black dots: 123 < m_{h0} or m_{H0} < 127 GeV

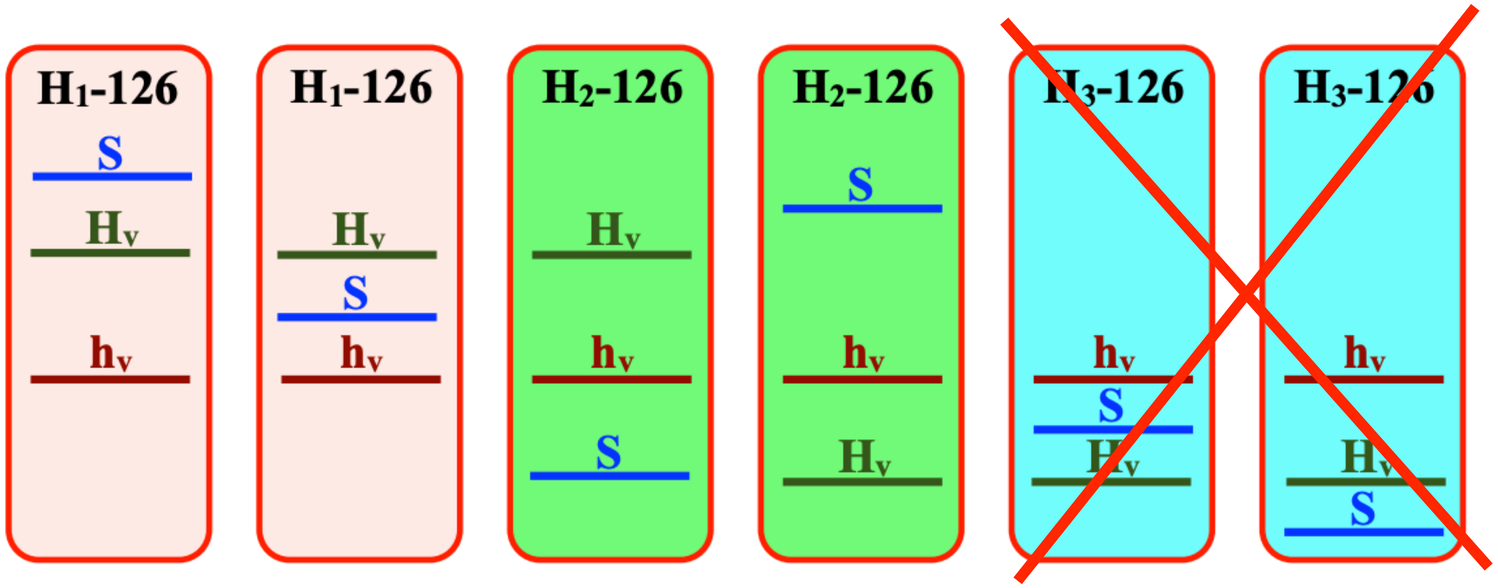
blue dots: $\sigma XBr(gg \to h^0, H^0 \to \gamma\gamma)_{MSSM} > 80\% (\sigma XBr)_{SM}$



2013

Low-Mass Higgs Bosons in the NMSSM and Their LHC Implications

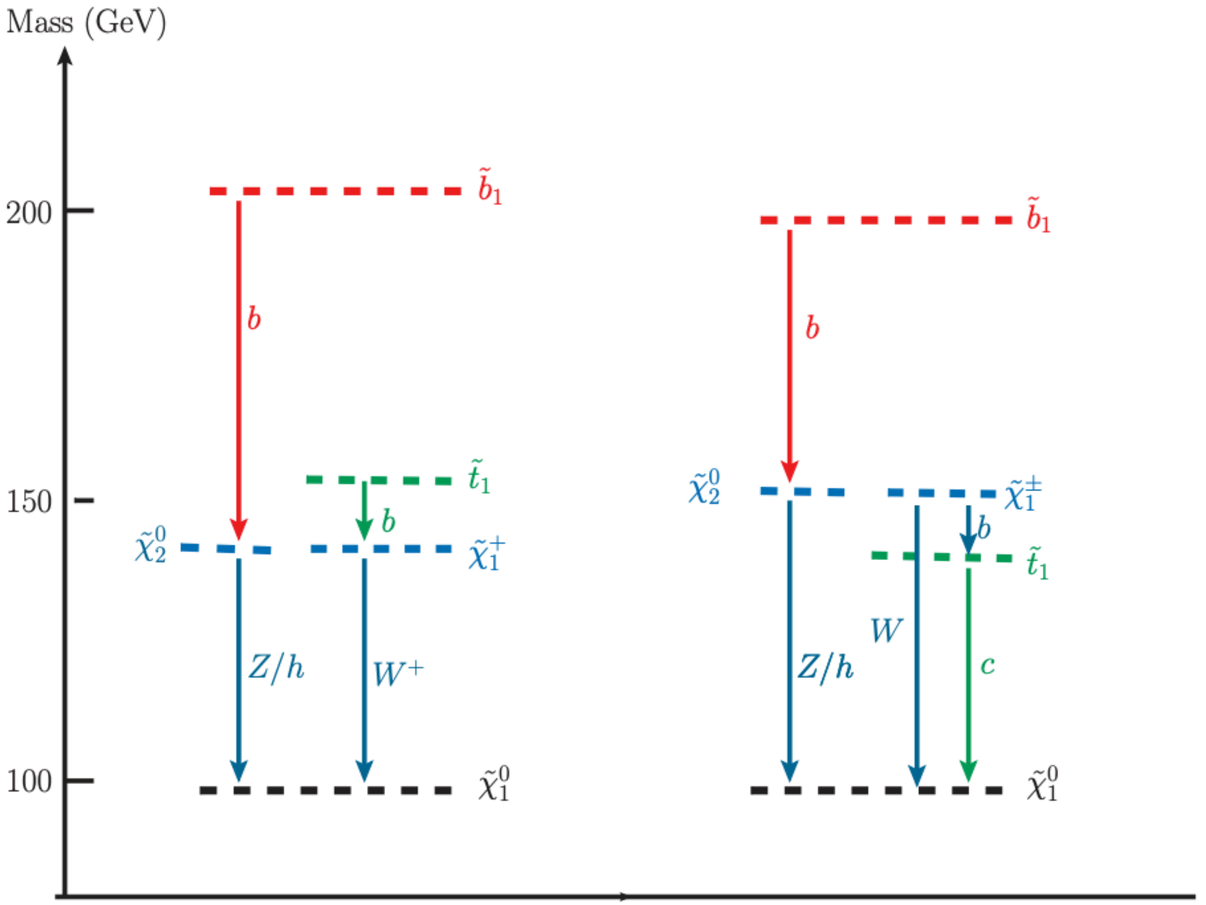
Christensen, Han, Liu, SS



Physics

2013

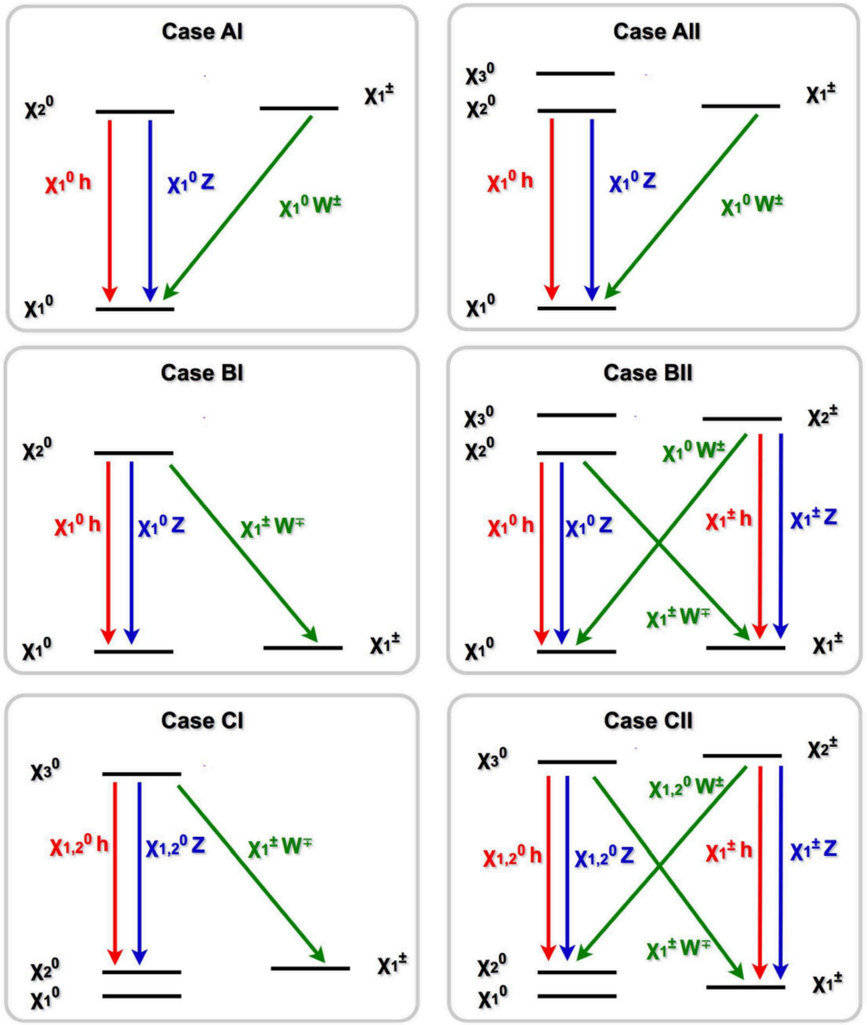
Non-Decoupling MSSM Higgs Sector and Light Superpartners, Han, Li, SS, Wang

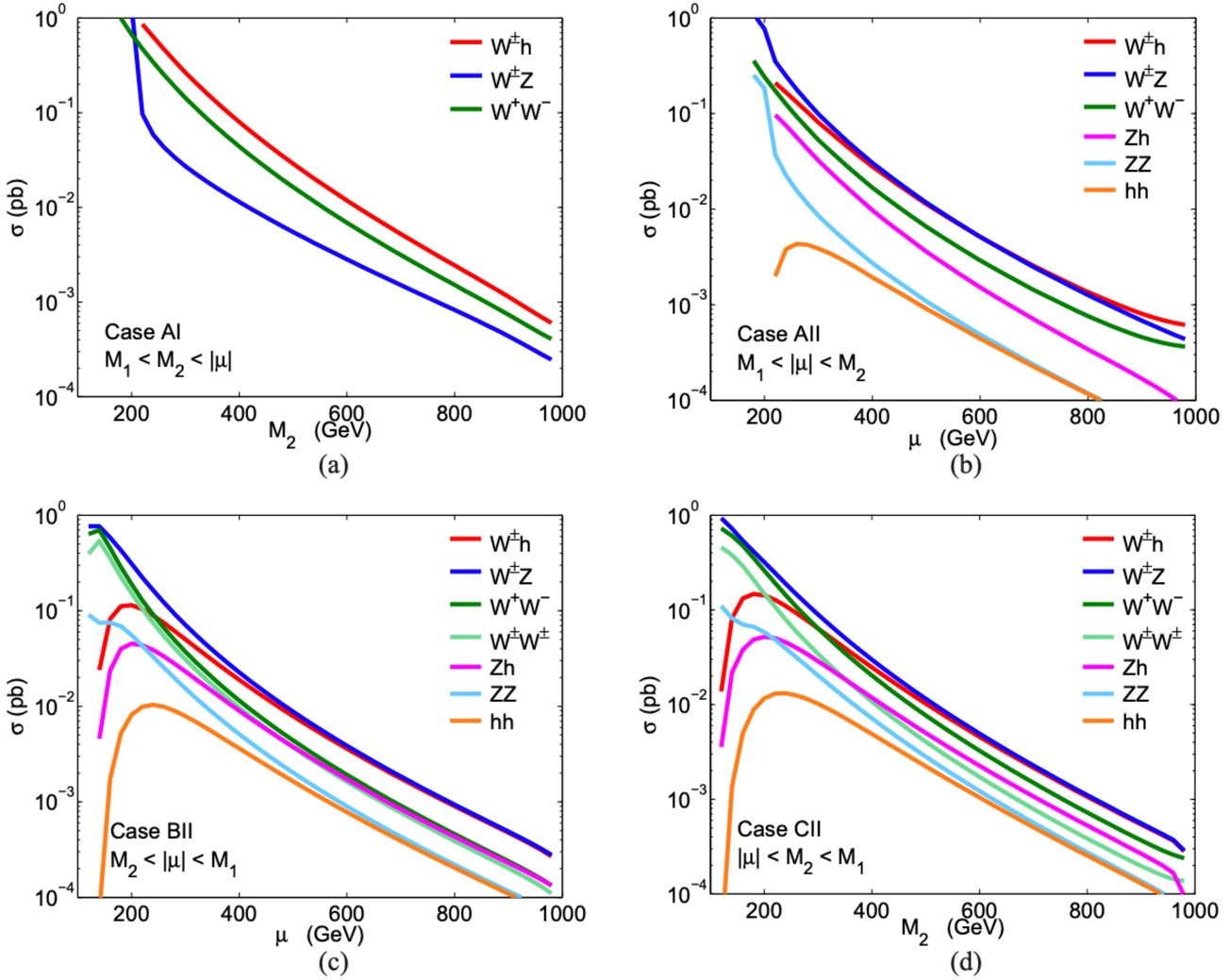


Physics

2013

Electroweakinos in the Light of the Higgs Boson, Han, Padhi, SS





2014

Light Neutralino dark Matter: Direct/Indirect Detections and Collider Searches

Han, Liu, SS

light neutralino dark matter (2 - 40 GeV)

	A_1/H_1 funnel	sb-coann	stau-coann
DM	Bino/Singlino	Bino	Bino/Singlino
light particle	$m_{A1/H1} \sim 2m_X$ singlet-like	$m_{sb} > 16$ GeV $\Delta m < m_b$	$m_{stau} > 32$ GeV $\Delta m < 3$-5 GeV
relic	✓	✓	✓
direct detection	✓		✓
indirect detection	✓	✓	✓
via SM Higgs	✓	✓	✓
LHC	✓	×	×
ILC	✓	✓	✓

2015

Sbottom Discovery via Mixed Decays at the LHC, Han, SS, Wu, Zhang, Zhang

2016

Unblinding the Dark Matter Blind Spot, Han, Kling, SS, Wu

Physics

2018

Type-II 2HDM Under the Prevision Measurements at the Z-pole and a Higgs Factory

Chen, Han, SS, Su, Wu

2019

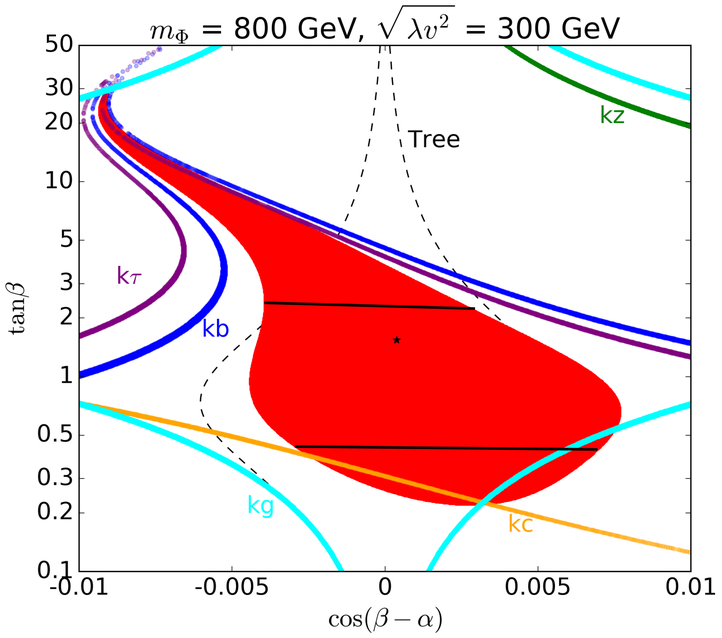
Type-I 2HDM Under the Higgs and Electroweak Prevision Measurements

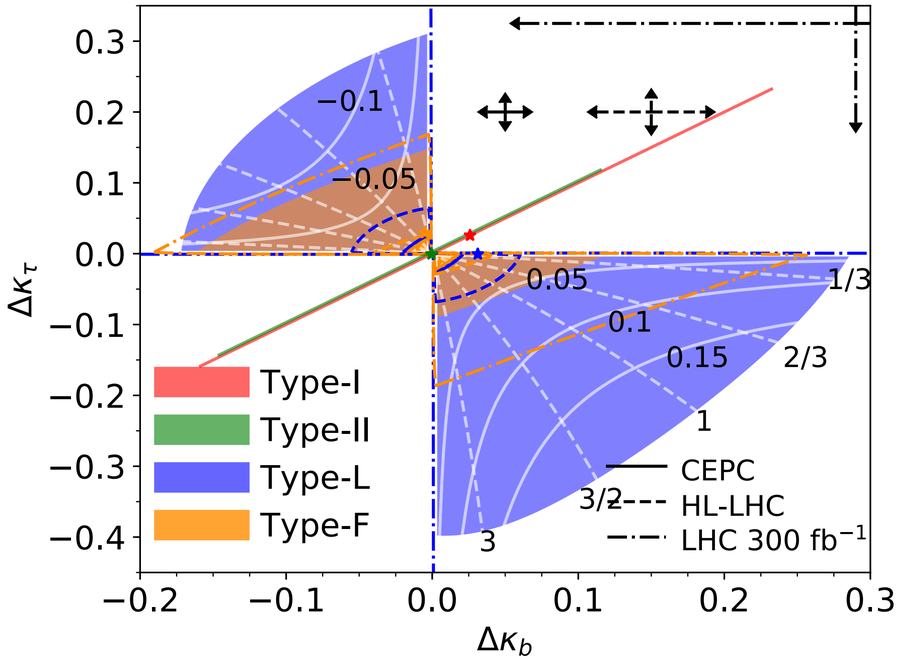
Chen, Han, Li, SS, Su

2020

Comparative Studies of 2HDMs Under the Higgs Boson Precision Measurements

Han, Li, SS, Su, Wu

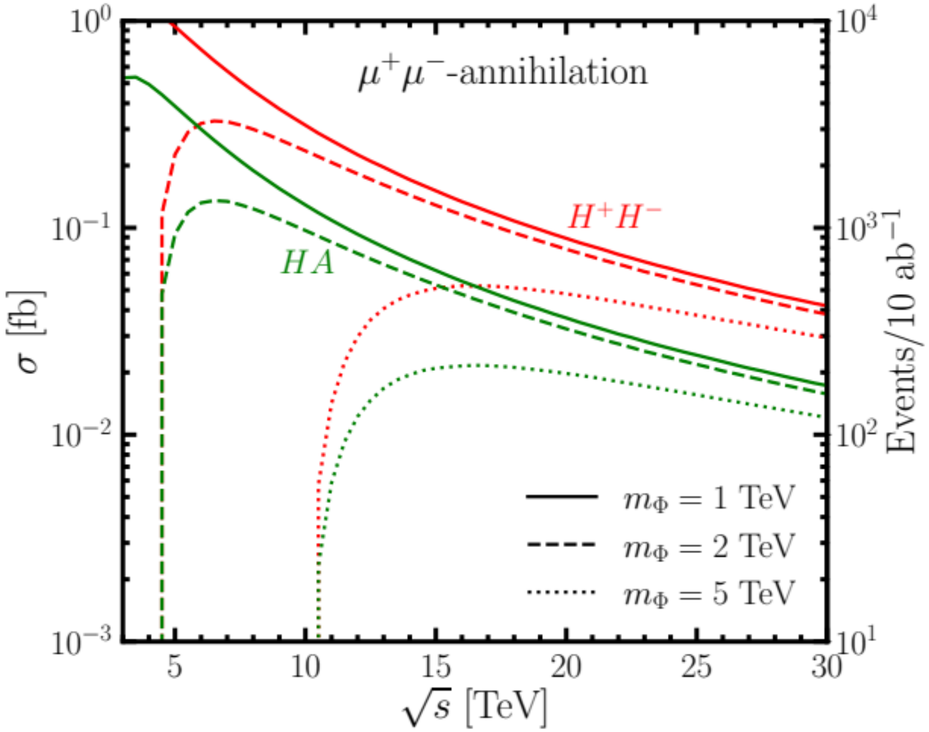


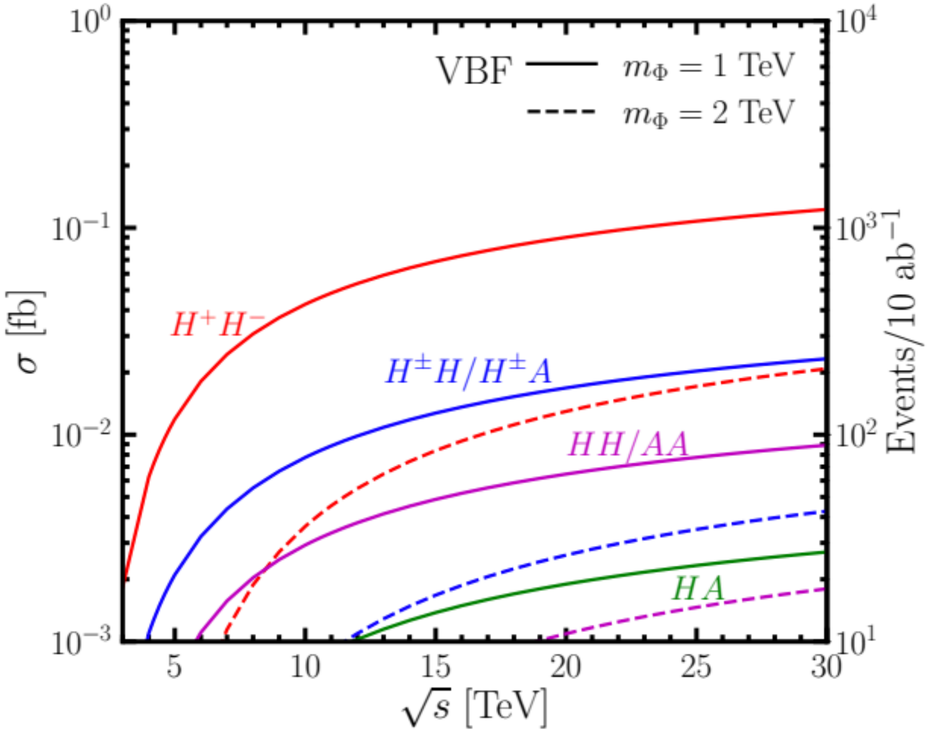


Physics

2021

Heavy Higgs Bosons in 2HDM at a muon Colliders, Han, Li, SS, Su, Wu

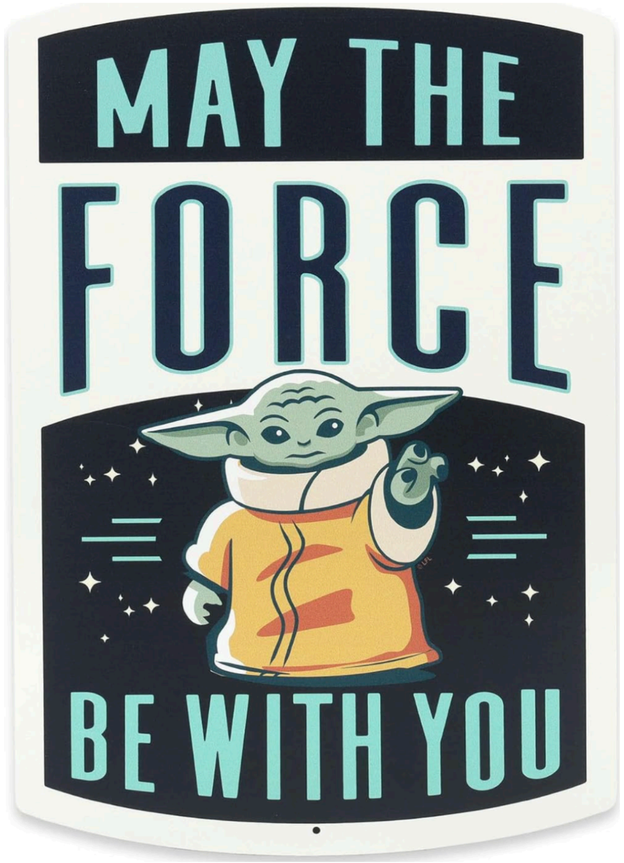




2024

Measuring Quantum Discord at the LHC, Han, Low, McGinnis, SS

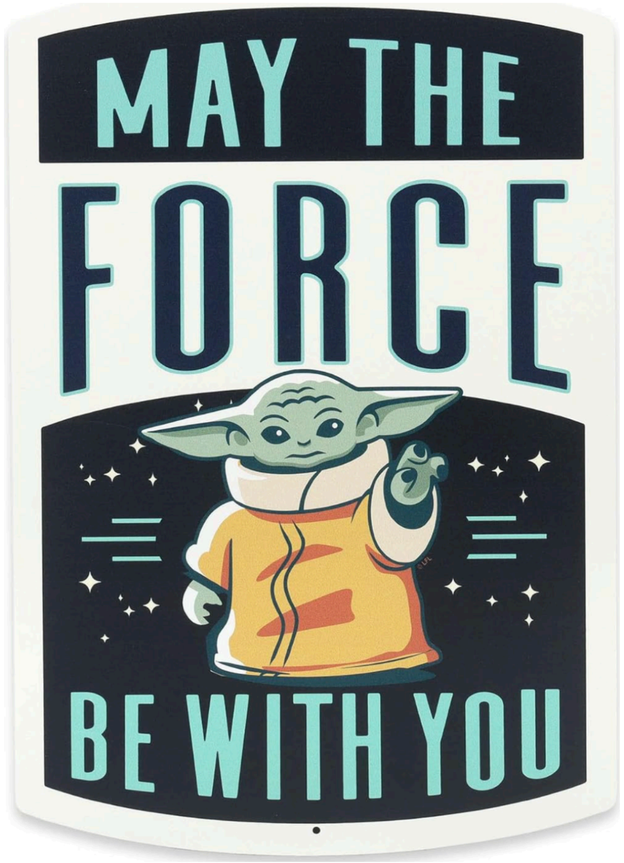
Physics



To Tao

- a great physicist and community leader
- a dedicated mentor and supporter
- a dear friend and someone just fun to hang out with

Physics



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The party is on …

Physics