Impact of the Higgs discovery on two models of new physics

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Probing the Standard Model and New Physics
at Low and High Energies
Portorož, 14-18 April 2013

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Check the inventory (nature) against the inventory list (Standard Model).

No theory explanation for the replication of fermion generations.
Can there be a Standard Model with a fourth generation (SM4), with new heavy fermions t', b', ℓ_4, ν_4?

My theory colleagues: Rather boring subject.

But: more than 500 papers on the subject in last 10 years

A fourth generation is non-decoupling, experimental constraints cannot be evaded by postulating ever increasing masses of the new particles.

Yukawa couplings grow with masses, $y_f = m_f/v$, which can compensate for the decrease of loop integrals.

Higgs data

LHC: experimental information on signal strengths

$$\hat{\mu}(pp \to H \to Y) = \frac{\sigma(pp \to H)B(H \to Y)|_{\text{SM4}}}{\sigma(pp \to H)B(H \to Y)|_{\text{SM3}}}$$

with $Y = \gamma\gamma, WW^*, ZZ^*, Vb\bar{b}, \tau\tau$.

The production cross section $\sigma(gg \to H)$ in the SM4 is 9 times larger than in the SM3 and essentially independent of $m_{t'}$, $m_{b'}$.

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No: Effect can be compensated by a large $B(H \to \nu_4\overline{\nu}_4) \equiv \Gamma(H \to \nu_4\overline{\nu}_4)/\Gamma_{\text{tot}}$, because the invisible width $\Gamma(H \to \nu_4\overline{\nu}_4)$ dominates Γ_{tot} for $m_{\nu_4} < M_H/2$.

Global fit

Global fit of electroweak precision data, five LHC Higgs signal strength and $\hat{\mu}(p\bar{p} \to H \to Vb\bar{b})$ from Tevatron using *CKMfitter*.

Otto Eberhardt	theory	KIT
Geoffrey Herbert	ATLAS	HU Berlin
Heiko Lacker	ATLAS	HU Berlin
Alexander Lenz	theory	CERN/Durham
Andreas Menzel		HU Berlin
UN	theory	KIT
Martin Wiebusch	theory	KIT

Phys.Rev. D86 (2012) 013011
Phys.Rev. D86 (2012) 074014
Phys.Rev.Lett. 109 (2012) 241802

To quantify the level at which a theory is disfavoured with respect to the SM one performs a likelihood ratio test.

Choose SM parameters $x_1, \ldots x_n$ and new-physics (NP) parameters $x_{n+1}, \ldots x_{n+k}$ such that $x_{n+1} = \ldots x_{n+k} = 0$ in the SM. Fit the theories to the observables O_i:

Step 1: Minimise χ^2 function for both theories,

$$\chi^2_{\mathrm{NP,min}}(O_i) = \min \chi^2(x_1, \ldots x_{n+k}) \quad \text{and}$$

$$\chi^2_{\mathrm{SM,min}}(O_i) = \min \chi^2(x_1, \ldots x_n, 0, \ldots 0).$$

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$$p = 1 - P_{k/2}(\frac{1}{2}\Delta\chi^2).$$

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Does not work for the SM4!

The SM4 and SM3 are non-nested models, i.e. one cannot recover the SM3 from the SM4 by fixing its extra parameters, due to the non-decoupling property.

Instead:

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Step 3: Fit both theories for each set of toy measurements and compute $\Delta\chi^2(O_i') := \chi^2_{\mathrm{SM4,min}}(O_i') - \chi^2_{\mathrm{SM,min}}(O_i')$.

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  $\Delta\chi^2(O_i) := \chi^2_{\text{SM4,min}}(O_i) - \chi^2_{\text{SM,min}}(O_i)$.
- Step 2: Generate a large sample of toy measurements O_i' distributed around the best-fit prediction of the SM4 (according to the errors of the O_i).
- Step 3: Fit both theories for each set of toy measurements and compute $\Delta\chi^2(O_i') := \chi^2_{\text{SM4,min}}(O_i') - \chi^2_{\text{SM,min}}(O_i')$.
- Step 4: The statistical significance of the SM4 is the fraction of toy measurements with $\Delta\chi^2(O_i') > \Delta\chi^2(O_i)$.

Challenge: To rule out a theory at 5σ, a p-value of $5.7 \cdot 10^{-7}$ must be calculated.

$\Rightarrow$ Need several million minimisations...

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$\Rightarrow$ Need several million minimisations...

. . . if toy measurements follow Gaussian distribution.

Idea: Importance sampling: Modify the probability function of the toy Monte-Carlo in such way that the central region of the Gaussian (corresponding to few standard deviations) is avoided (i.e. fit only to the tail of the Gaussian).

$\Rightarrow$ Speedup of a factor of 100-1000.

M.Wiebusch, *myFitter*, arXiv:1207.1446, http://myfitter.hepforge.org

Result

We find an excellent fit to the SM3. The p-value of the SM4 is $p = 1.1 \cdot 10^{-7}$, corresponding to 5.3σ. Without the Tevatron data on $p\bar{p} \to Vb\bar{b}$ we find $p = 1.9 \cdot 10^{-6}$, corresponding to 4.8σ.

The exclusion of the SM4 corresponds to the perturbative regime only.

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Why don't you rule out the third generation next?"

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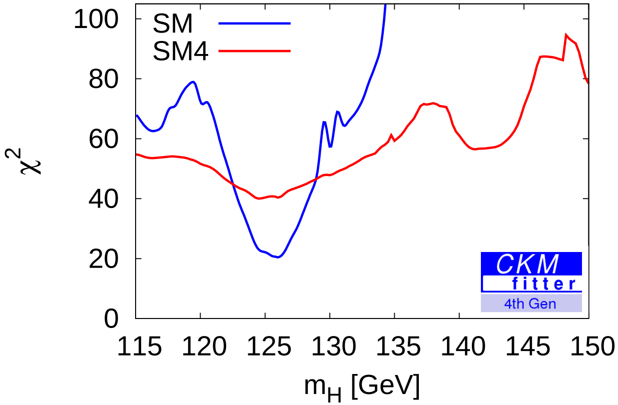
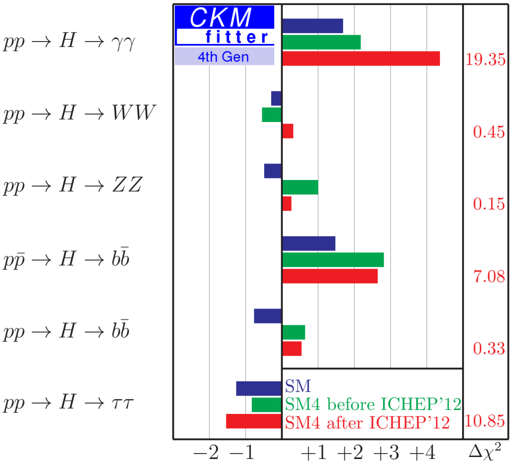
PRL 109 (2012) 241802 also contains the first combined fit to Higgs signal strengths and electroweak precision observables (EWPO) after the Higgs discovery. For the EWPO we have used the Zfitter program.

Higgs mass



SM3: $m_H = 126.00^{+0.36}_{-0.67}$

Higgs signal strengths



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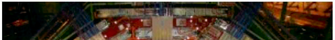
by Donovan Crow

Limited Number of Fermions in Standard Model show 12 Matter Particles Suffice in Nature

Friday December, 2012 *in* Quantum Physics

Matter particles, also called fermions, are the elementary components of the universe. They make up everything we see on earth or through telescopes. “For a long time, however, it was not clear whether we know all components,” explains Ulrich Nierste, Professor at KIT. The standard model of particle physics knows 12 fermions. Based on their similar properties, they are divided into three



Supersymmetry

The MSSM has many new sources of flavour violation, all in the supersymmetry-breaking sector.

No problem to get a big effect in a given FCNC process, but rather to suppress big effects elsewhere (supersymmetric flavour problem).

Squark mass matrix

Diagonalise the Yukawa matrices Y^u_{jk} and Y^d_{jk}

$\Rightarrow$ quark mass matrices are diagonal, super-CKM basis

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E.g. Down-squark mass matrix:

$$M^2_{\tilde{d}} = \begin{pmatrix} \left(M^{\tilde{d}}_{1L}\right)^2 & \Delta^{\tilde{d}\,LL}_{12} & \Delta^{\tilde{d}\,LL}_{13} & \Delta^{\tilde{d}\,LR}_{11} & \Delta^{\tilde{d}\,LR}_{12} & \Delta^{\tilde{d}\,LR}_{13} \\ {\Delta^{\tilde{d}\,LL}_{12}}^* & \left(M^{\tilde{d}}_{2L}\right)^2 & \Delta^{\tilde{d}\,LL}_{23} & {\Delta^{\tilde{d}\,RL}_{12}}^* & \Delta^{\tilde{d}\,LR}_{22} & \Delta^{\tilde{d}\,LR}_{23} \\ {\Delta^{\tilde{d}\,LL}_{13}}^* & {\Delta^{\tilde{d}\,LL}_{23}}^* & \left(M^{\tilde{d}}_{3L}\right)^2 & {\Delta^{\tilde{d}RL}_{13}}^* & \Delta^{\tilde{d}\,RL*}_{23} & \Delta^{\tilde{d}\,LR}_{33} \\ {\Delta^{\tilde{d}\,LR}_{11}}^* & \Delta^{\tilde{d}RL}_{12} & \Delta^{\tilde{d}RL}_{13} & \left(M^{\tilde{d}}_{1R}\right)^2 & \Delta^{\tilde{d}\,RR}_{12} & \Delta^{\tilde{d}\,RR}_{13} \\ {\Delta^{\tilde{d}\,LR}_{12}}^* & \Delta^{\tilde{d}\,LR*}_{22} & \Delta^{\tilde{d}RL}_{23} & {\Delta^{\tilde{d}\,RR}_{12}}^* & \left(M^{\tilde{d}}_{2R}\right)^2 & \Delta^{\tilde{d}\,RR}_{23} \\ {\Delta^{\tilde{d}\,LR}_{13}}^* & {\Delta^{\tilde{d}\,LR}_{23}}^* & {\Delta^{\tilde{d}\,LR}_{33}}^* & {\Delta^{\tilde{d}\,RR}_{13}}^* & {\Delta^{\tilde{d}\,RR}_{23}}^* & \left(M^{\tilde{d}}_{3R}\right)^2 \end{pmatrix}$$

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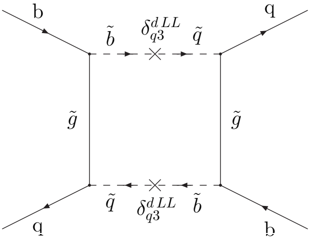
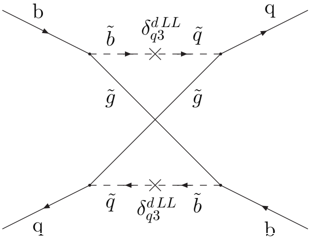
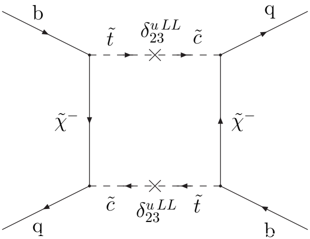
Not diagonal! $\Rightarrow$ new FCNC transitions.







$$\delta_{ij}^{q\,LL} = \frac{\Delta_{ij}^{\tilde{q}\,LL}}{\frac{1}{6}\sum_s M^2_{\tilde{q},ss}}, \qquad q{=}u,d$$

With squark masses well beyond 1 TeV the supersymmetric flavour problem is somewhat alleviated.

Desirable: SUSY models with “controlled” deviations from Minimal Flavour Violation (MFV): Detectable effects in some observables, with sufficiently constrained parameters.

Flavour and SUSY GUT

Linking quarks to neutrinos: Flavour mixing:

quarks: Cabibbo-Kobayashi-Maskawa (CKM) matrix

leptons: Pontecorvo-Maki-Nakagawa-Sakata (PMNS) matrix

Consider SU(5) multiplets:

$$\overline{\mathbf{5}}_1 = \begin{pmatrix} d_R^c \\ d_R^c \\ d_R^c \\ e_L \\ -\nu_e \end{pmatrix}, \qquad \overline{\mathbf{5}}_2 = \begin{pmatrix} s_R^c \\ s_R^c \\ s_R^c \\ \mu_L \\ -\nu_\mu \end{pmatrix}, \qquad \overline{\mathbf{5}}_3 = \begin{pmatrix} b_R^c \\ b_R^c \\ b_R^c \\ \tau_L \\ -\nu_\tau \end{pmatrix}.$$

If the observed large atmospheric neutrino mixing angle stems from a rotation of $\overline{\mathbf{5}}_2$ and $\overline{\mathbf{5}}_3$, it will induce a large $\tilde{b}_R - \tilde{s}_R$-mixing (Moroi; Chang,Masiero,Murayama).

$\Rightarrow$ new b_R–s_R transitions from gluino–squark loops possible.

Key ingredients: Some weak basis with

$$\mathsf{Y}_d = V^*_{\mathrm{CKM}} \begin{pmatrix} y_d & 0 & 0 \\ 0 & y_s & 0 \\ 0 & 0 & y_b \end{pmatrix} U_{\mathrm{PMNS}}$$

and right-handed down squark mass matrix:

$$\mathsf{m}^2_{\tilde{d}}\,(M_Z) = \mathrm{diag}\,\left(m^2_{\tilde{d}}, m^2_{\tilde{d}}, m^2_{\tilde{d}} - \Delta_{\tilde{d}}\right).$$

with a calculable real parameter $\Delta_{\tilde{d}}$, typically generated by top-Yukawa RG effects.

Rotating Y_d to diagonal form puts the large atmospheric neutrino mixing angle into $m^2_{\tilde{d}}$:

$$U^\dagger_{\rm PMNS}\, m^2_{\tilde{d}}\, U_{\rm PMNS} = \begin{pmatrix} m^2_{\tilde{d}} & 0 & 0 \\ 0 & m^2_{\tilde{d}} - \frac{1}{2}\,\Delta_{\tilde{d}} & -\frac{1}{2}\,\Delta_{\tilde{d}}\, e^{i\xi} \\ 0 & -\frac{1}{2}\,\Delta_{\tilde{d}}\, e^{-i\xi} & m^2_{\tilde{d}} - \frac{1}{2}\,\Delta_{\tilde{d}} \end{pmatrix}$$

The CP phase ξ affects CP violation in $B_s - \overline{B}_s$ mixing!

The Chang–Masiero–Murayama (CMM) model is based on the symmetry breaking chain

$SO(10) \rightarrow SU(5) \rightarrow SU(3) \times SU(2)_L \times U(1)_Y$.

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SO(10) superpotential:

$$W_Y = \frac{1}{2} 16_i \, Y_u^{ij} \, 16_j \, 10_H + \frac{1}{2} 16_i \, Y_d^{ij} \, 16_j \, \frac{45_H \, 10'_H}{M_{\text{Pl}}} + \frac{1}{2} 16_i \, Y_N^{ij} \, 16_j \, \frac{\overline{16}_H \overline{16}_H}{M_{\text{Pl}}}$$

with the Planck mass M_{Pl} and

- 16_i: one matter superfield per generation, $i = 1, 2, 3$,
- 10_H: Higgs superfield containing MSSM Higgs superfield H_u,
- $10'_H$: Higgs superfield containing MSSM superfield H_u,
- 45_H: Higgs superfield in adjoint representation,
- $\overline{16}_H$: Higgs superfield in spinor representation.

“Most minimal flavour violation”

The Yukawa matrices Y_u and Y_N are always symmetric. In the CMM model they are assumed to be simultaneously diagonalisable at the scale M_{Pl}, where the soft SUSY-breaking terms are universal.

Chang-Masiero-Murayama model

We have considered $B_s - \overline{B}_s$ mixing, $b \to s\gamma$, $\tau \to \mu\gamma$, vacuum stability bounds, lower bounds on sparticle masses and the mass of the lightest Higgs boson.
The analysis involves 7 parameters in addition to those of the Standard Model.

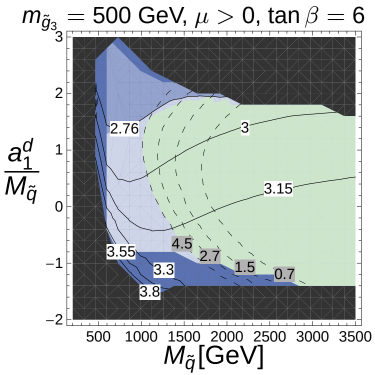
Generic results: Largest effects in $B_s - \overline{B}_s$ mixing, $\tau \to \mu\gamma$

J. Girrbach, S. Jäger, M. Knopf, W. Martens, UN, C. Scherrer, S. Wiesenfeldt
1101.6047

Input:

- squark masses $M_{\tilde{u}}$, $M_{\tilde{d}}$ of right-handed up and down squarks,
- trilinear term a_1^d of first generation,
- gluino mass $m_{\tilde{g}_3}$,
- $\arg\mu$,
- $\tan\beta$

2011 fit:



Black: negative soft masses^2
Gray blue: excluded by $\tau \to \mu\gamma$
Medium blue: excluded by $b \to s\gamma$
Dark blue: excluded by $B_s - \overline{B}_s$ mixing
Green: allowed

solid lines: $10^4 \cdot Br(b \to s\gamma)$; dashed lines: $10^8 \cdot Br(\tau \to \mu\gamma)$.

Two developments since 2011:

1. Measurement of a sizable θ_{13}:

$$\left[U^\dagger_{\mathrm{PMNS}}\, \mathsf{m}^2_{\tilde{d}}\, U_{\mathrm{PMNS}}\right]_{12} = \cos(\theta_{13}) \sin\theta_{13} \sin\theta_{23} \Delta_{\tilde{d}}$$

$\Rightarrow$ $B(\mu \to e\gamma) \leq 5.7 \cdot 10^{-13}$ (MEG 2013) pushes sfermion masses up.

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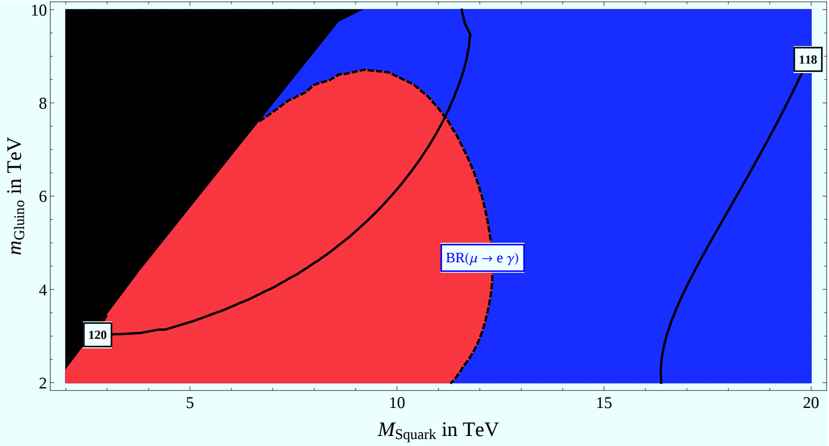
$\Rightarrow$ $B(\mu \to e\gamma) \leq 5.7 \cdot 10^{-13}$ (MEG 2013) pushes sfermion masses up.

2. Discovery of a Higgs particle with $M_h = 126$ GeV. Difficult (impossible?) to account for in the CMM model.

J. Stöckel, UN, work in progress:



for $\tan\beta = 10$, $\mu > 0$, marginal dependence on a_1^d.

White labels: Higgs mass. Red: excluded by $\mu \to e\gamma$. Black: too light $\widetilde{t}_R$.

Owing to the large value of θ_{13} the constraint from $B(\mu \to e\gamma)$ supersedes those from $b \to s$ and $\tau \to \mu$ FCNC processes. The CMM model (with its typically large sfermion mass spitting at M_{GUT}) needs uncomfortably heavy sfermion and gaugino masses.

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There is a conflict between $M_h = 126$ GeV and the vacuum stability bound for a_1^d. We can accomodate $M_h = 126$ GeV by passing from the MSSM to the NMSSM.

Conclusions

- The Standard Model with a perturbative 4th fermion generation is ruled out at the level of 5.3σ.

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- The Standard Model with a perturbative 4th fermion generation is ruled out at the level of 5.3σ.
- Models of GUT flavour physics with $\tilde{b} \to \tilde{s}$ transitions driven by the atmospheric neutrino mixing angle are substantially affected by $B(\mu \to e\gamma)$ and seriously challenged by $M_h = 126\,\text{GeV}$.

The quantum numbers of the SM point towards a grand unified theory (GUT), the gauge couplings converge to a common GUT value at high energies, similarly y_τ and y_b converge, and neutrinos have small masses as predicted by GUT pioneers.

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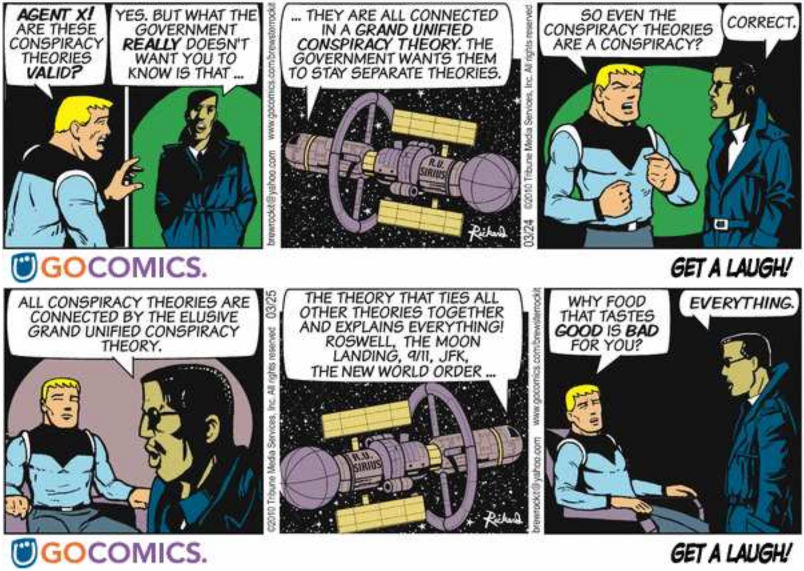
So is this just a conspiracy of Nature? Or even...


AGENT X! ARE THESE CONSPIRACY THEORIES VALID?
YES. BUT WHAT THE GOVERNMENT REALLY DOESN'T WANT YOU TO KNOW IS THAT ...
... THEY ARE ALL CONNECTED IN A GRAND UNIFIED CONSPIRACY THEORY. THE GOVERNMENT WANTS THEM TO STAY SEPARATE THEORIES.
SO EVEN THE CONSPIRACY THEORIES ARE A CONSPIRACY?
CORRECT.
GOCOMICS.
GET A LAUGH!
ALL CONSPIRACY THEORIES ARE CONNECTED BY THE ELUSIVE GRAND UNIFIED CONSPIRACY THEORY.
THE THEORY THAT TIES ALL OTHER THEORIES TOGETHER AND EXPLAINS EVERYTHING! ROSWELL, THE MOON LANDING, 9/11, JFK, THE NEW WORLD ORDER ...
WHY FOOD THAT TASTES GOOD IS BAD FOR YOU?
EVERYTHING.
GOCOMICS.
GET A LAUGH!

Backup slides

Oblique electroweak corrections

New physics with particle masses well above M_Z, no extra gauge bosons and no Z-vertex corrections affect electroweak precision observables through the parameters S, T, and U, calculated from self-energy diagrams of Z, γ, and W.

The non-decoupling of heavy chiral fermions from S lead to a premature obituary notice of the SM4 in the Particle Data Table.

But: Contribution of (t', b') to S:

$$\Delta S = \frac{1}{2\pi}\left[1 - \frac{1}{3}\ln\frac{m_{t'}}{m_{b'}}\right]$$

Peskin, Takeuchi (1991)

$\Rightarrow$ Only degenerate doublets are ruled out.

$$\Delta T \simeq \frac{1}{12\pi \sin^2\theta_W \cos^2\theta_W}\frac{(m_{t'}^2 - m_{b'})^2}{m_{b'}^2 M_Z^2} \quad \text{for } |m_{t'}^2 - m_{b'}^2| \ll m_{b'}^2.$$

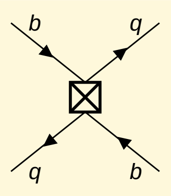
Electroweak precision data perfectly allow simultaneously positive ΔS and ΔT.

Kribs et al. (2007)

Other freedom: Permit fermion mixing, but then must deal with non-oblique corrections to $Z \to b\overline{b}$.

Δm_s and Δm_d

Operator Product Expansion:



$$M_{12}^q = |V_{tq}^* V_{tb}|^2 \, C Q$$

Local Operator:

$$Q = \overline{q}_L \gamma_\nu b_L \, \overline{q}_L \gamma^\nu b_L$$

Theoretical uncertainty of Δm_q dominated by matrix element:

$$\langle \mathrm{B_q} | Q | \overline{\mathrm{B}}_q \rangle = \frac{2}{3} M_{B_q}^2 \, f_{B_q}^2 \, B_{B_q}$$

Standard Model: $C = C(m_t, \alpha_s)$ is well-known.

Δm_s

$\mathrm{B_s}-\overline{\mathrm{B}}_\mathrm{s}$ mixing: CKM unitarity fixes $|V_{ts}| \simeq |V_{cb}|$. Use lattice results for $f_{B_q}^2\, B_{B_q}$ to confront $\Delta m_s^{\mathrm{exp}}$ with the Standard Model:

$$\Delta m_s = \left(18.8 \pm 0.6_{\,V_{cb}} \pm 0.3_{\,m_t} \pm 0.1_{\,\alpha_s} \right) \mathrm{ps}^{-1} \, \frac{f_{B_s}^2\, B_{B_s}}{(220\,\mathrm{MeV})^2}$$

Here $\overline{\mathrm{MS}}$-NDR scheme for B_{B_q} at scale m_b.

Often used: scheme-invariant $\widehat{B}_{B_q} = 1.51 B_{B_q}$.

Recall:

$$\Delta m_s = \left(18.8 \pm 0.6_{V_{cb}} \pm 0.3_{m_t} \pm 0.1_{\alpha_s} \right) \text{ps}^{-1} \frac{f_{B_s}^2 B_{B_s}}{(220\,\text{MeV})^2}$$

CKMfitter lattice averages (1203.0238):

$$f_{B_s} = (229 \pm 2 \pm 6)\,\text{MeV}, \qquad B_{B_s} = 0.85 \pm 0.02 \pm 0.02$$

means $f_{B_s}^2 B_{B_s} = (211 \pm 9)\,\text{MeV}$ and

$$\Delta m_s = (17.3 \pm 1.5)\,\text{ps}^{-1}$$

complying with LHCb/CDF average

$$\Delta m_s^{\text{exp}} = (17.731 \pm 0.045)\,\text{ps}^{-1}$$

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Few lattice-QCD calculations of $f_{B_s}^2 B_{B_s}$ available!

Prediction of Δm_s largely relies on calculations of f_{B_s} and the prejudice $B_{B_s} \simeq 0.85$.

With recent preliminary Fermilab/MILC result (1112.5642),

$$f_{B_s}^2 B_{B_s} = 0.0559(68)\,\text{GeV}^2 \simeq [(237 \pm 14)\,\text{MeV}]^2\,,$$

one finds

$$\Delta m_s = (21.7 \pm 2.6)\,\text{ps}^{-1}$$

Decay matrix

The calculation Γ_{12}^q, $q = d, s$, is needed for

the width difference $\Delta\Gamma_q \simeq 2|\Gamma_{12}^q| \cos\phi_q$

and the semileptonic CP asymmetry $a_{\rm fs}^q = \frac{|\Gamma_{12}^q|}{|M_{12}^q|} \sin\phi_q$

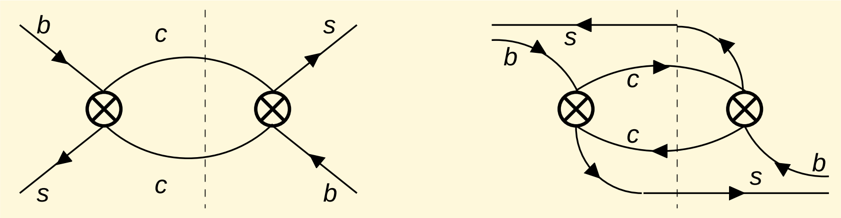
In the Standard Model

$$\phi_s = 0.22^\circ \pm 0.06^\circ \quad \text{and} \quad \phi_d = -4.3^\circ \pm 1.4^\circ.$$

Recalling $\phi_q = \arg\left(-\frac{M_{12}^q}{\Gamma_{12}^q}\right)$, a new physics contribution to $\arg M_{12}^q$ may deplete $\Delta\Gamma_q$ and enhance $|a_{\rm fs}^q|$ to a level observable at current experiments.

But: Precise data on CP violation in $B_d \to J/\psi K_S$ and $B_s \to J/\psi\phi$ preclude large NP contributions to $\arg\phi_d$ and $\arg\phi_s$.

Leading contribution to Γ_{12}^{s}:



Γ_{12}^{s} stems from Cabibbo-favoured tree-level $b \to c\bar{c}s$ decays, sizable new-physics contributions are impossible.

Updated Standard-Model prediction for $\Delta\Gamma_s/\Delta m_s$ in terms of hadronic parameters:

$$\frac{\Delta\Gamma_s}{\Delta m_s}\Delta m_s^{\rm exp} = \left[0.082 + 0.019\frac{\widetilde{B}'_{S,B_s}}{B_{B_s}} - 0.025\frac{B_R}{B_{B_s}}\right] \text{ps}^{-1}$$

Here

$$\langle B_s|\overline{s}_L^{\alpha} b_R^{\beta}\, \overline{s}_L^{\beta} b_R^{\alpha}|\overline{B}_s\rangle = \frac{1}{12} M_{B_s}^2\, f_{B_s}^2\, \widetilde{B}'_{S,B_s}$$

and $B_R = 1 \pm 0.5$ parametrises the size of higher-dimension operators.

With preliminary Fermilab/MILC result (1112.5642),

$$\frac{\widetilde{B}'_{S,B_s}}{B_{B_S}} = 1.23 \pm 0.24$$

find:

$$\frac{\Delta\Gamma_s}{\Delta m_s}\Delta m^{\mathrm{exp}} = \left[0.075 \pm 0.015_{B_R/B} \pm 0.012_{\mathrm{scale}} \pm 0.004_{\widetilde{B}/B}\right] \mathrm{ps}^{-1}$$

complies well with LHCb-CDF-DØ average

$$\Delta\Gamma_s = [0.105 \pm 0.015]\,\mathrm{ps}^{-1} \qquad \text{HFAG 2012}$$

New physics in Γ_{12}^q?

The LHCb measurement of Γ_s implies

$$\frac{\Gamma_d}{\Gamma_s} = \frac{\tau_{B_s}}{\tau_{B_d}} = 0.997 \pm 0.013$$

in excellent agreement with the SM prediction $\tau_{B_s}/\tau_{B_d} = 0.998 \pm 0.003$.
Changing the Cabibbo-favoured tree-level quantity $|\Gamma_{12}^s|$ by opening new enhanced decay channels such as $B_s \to \tau^+\tau^-$ will spoil this ratio.

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Phenomenologically, new physics in the doubly Cabibbo-suppressed quantity Γ_{12}^d is still allowed, but requires somewhat contrived models of new physics.

Deviations of EWPO