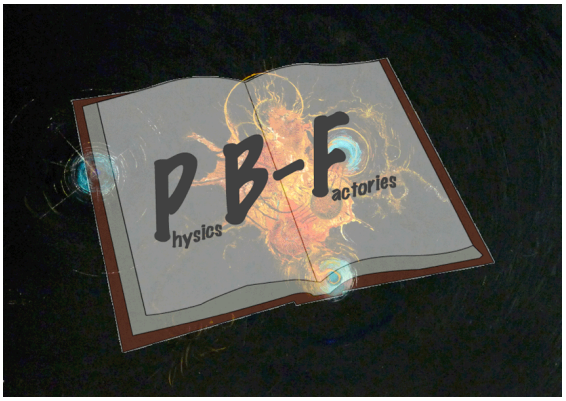

Section 22.2: Benchmark "New Physics" Models

Emi Kou (LAL-Orsay)
Jure Zupan (Cincinnati and Ljubljana)

4th workshop of PBF @ LAPP Annecy
29-30th June 2011

Outline of Section 22.2

- Section 22: Global interpretation
  - Subsection 22.1: Global CKM fit
  - Subsection 22.2: Benchmark "new physics" models

In this section, we present the impacts of the results from the B factories on the *specific* new physics models. We focus on the several B factory measurements which played significant roles in eliminating or constraining those new physics models.
Maximum of 10 pages

Outline of Section 22.2

Preliminary plan presented in the previous meeting

- Section 22: Global interpretation
  - Subsection 22.1: Global CKM fit
  - Subsection 22.2: Benchmark "new physics" models
    - Subsection 22.2.1: Approximate CP model (c.f. $\sin 2\Phi_1$)
    - Subsection 22.2.2: SUSY MFV (c.f. $b \to s\gamma$?)
    - Subsection 22.2.3: SUSY non-MFV (c.f. $b \to s\gamma$, $B \to \Phi K_S$, $\eta' K_S$)
    - Subsection 22.2.4: Additional Scalar 2HDM (c.f. $B \to \tau\nu$, $B \to D\tau\nu$)

Outline of Section 22.2

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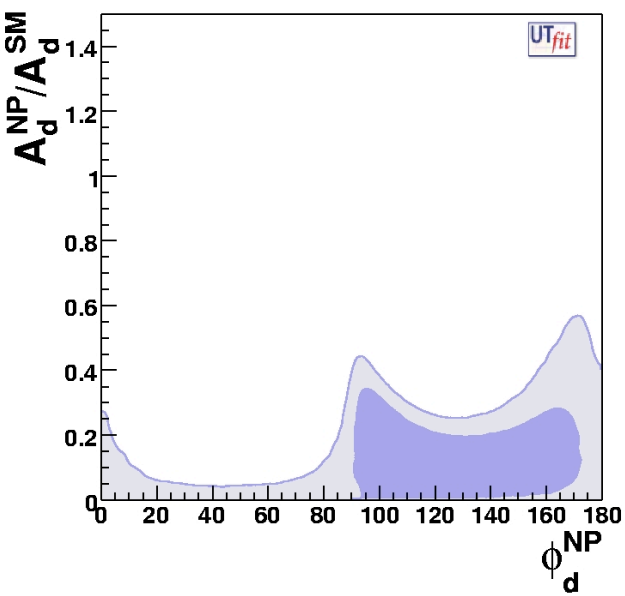
We went through "old" documents to see if we are not missing something important...

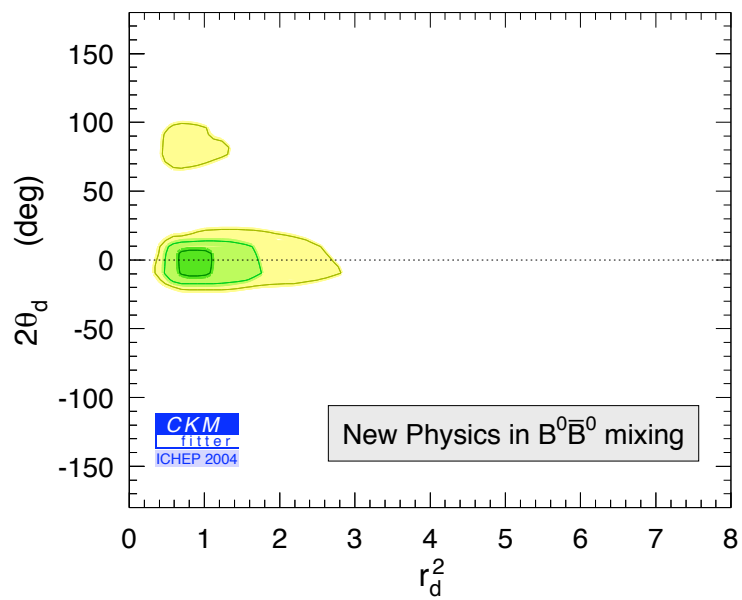
Babar book
Chapter 13: Beyond SM

Babar book
Chapter 13: Beyond SM

- 13.1: Baryogenesis *--- to be added*
- 13.2: Model independent analysis

--- to be discussed with fitter editors





Babar book
Chapter 13: Beyond SM

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- 13.2: Model independent analysis

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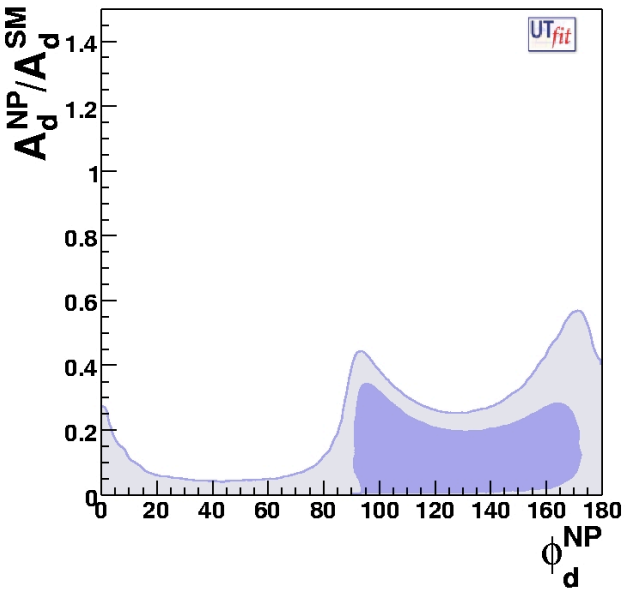
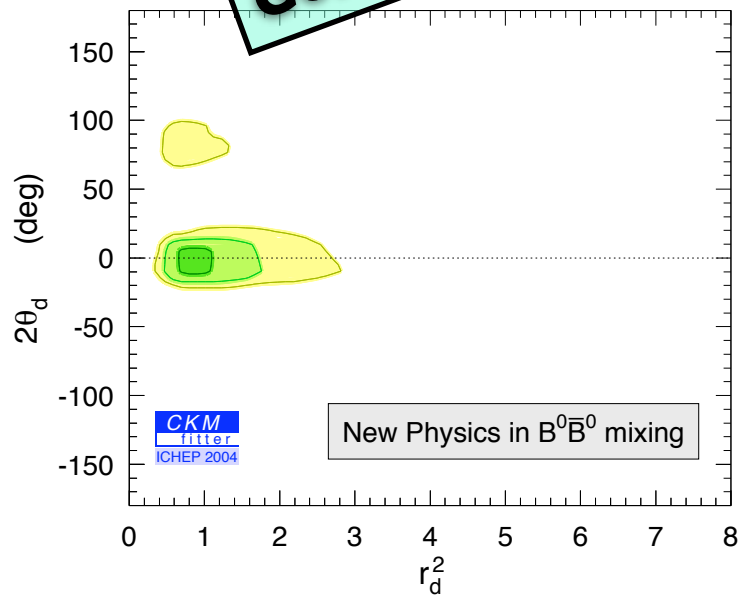
Going to Section 13?

Going to Section 22.1?





- 13.4 SUSY
  - 13.4.1-2 SUSY CP problem (many hadronic modes mentioned) *--- to be added*
  - 13.4.3 R parity violation (constraint on λ)
  - 13.4.4 Mass insertion *--- we already have*
- 13.5 Extra Higgs
  - Radiative decays sensitive
  - Helicity enhancement *--- we already have*

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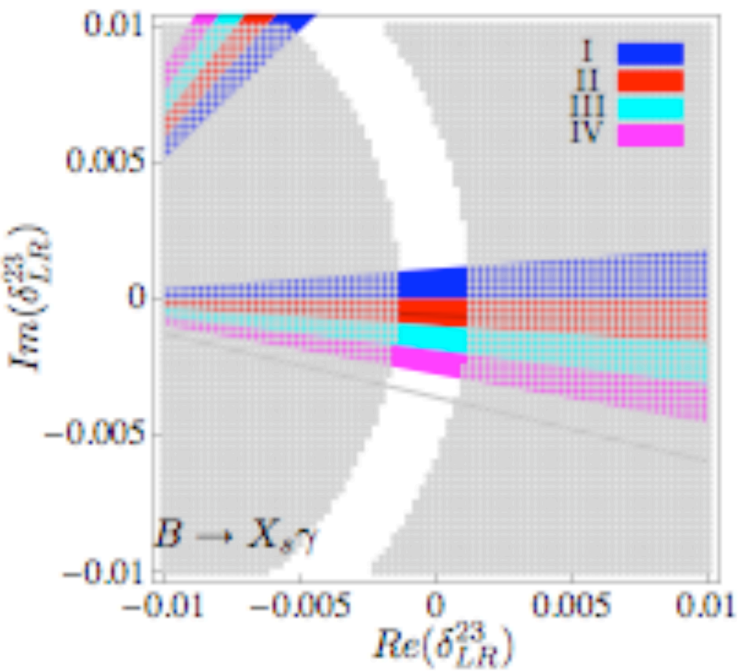

- 13.6 Extra Fermions *--- to be added*
  - 4th generation: D-Dbar mixing, Z penguin
- 13.7 Left-Right symmetric model

  --- maybe for the future part...
- 13.8 Strong Dynamics models

  --- maybe as RS model...

Table 13-6. *Model-dependent effects of new physics in various processes.*

Model	CP Violation		Rare Decays	D^0–$\overline{D}^0$ Mixing
	B^0_d–$\overline{B}^0_d$ Mixing	Decay Ampl.		
MSSM	$\mathcal{O}(20\%)$ SM Same Phase	No Effect	$B \to X_s\gamma$ – yes $B \to X_s\, l^+ l^-$ – no	No Effect
SUSY – Alignment	$\mathcal{O}(20\%)$ SM New Phases	$\mathcal{O}(1)$	Small Effect	Big Effect
SUSY – Approx. Universality	$\mathcal{O}(20\%)$ SM New Phases	$\mathcal{O}(1)$	No Effect	No Effect
R-Parity Violation	Can Do	Everything	Except Make	Coffee
MHDM 2HDM	$\sim$ SM/New Phases $\sim$ SM/Same Phase	Suppressed Suppressed	$B \to X_s\gamma, B \to X_s\tau\tau$ $B \to X_s\gamma$	Big Effect No Effect
Quark Singlets Fourth Generation	Yes/New Phases $\sim$ SM/New Phases	Yes Yes	Saturates Limits Saturates Limits	$Q = 2/3$ Big Effect
LRM – $V_L = V_R$ – $V_L \neq V_R$	No Effect Big/New Phases	No Effect Yes	$B \to X_s\gamma, B \to X_s\, l^+ l^-$ $B \to X_s\gamma, B \to X_s\, l^+ l^-$	No Effect No Effect
DEWSB	Big/Same Phase	No Effect	$B \to X_s\ell\ell, B \to X - s\nu\overline{\nu}$	Big Effect

Top Ten Models constrained by $b \rightarrow s\gamma$

J. Hewett, hep-ph/9406302

- Model I: SM *--- to be added*
- Model II: Anomalous top coupling
- Model III: Anomalous WWγ coupling
- Model IV: 2HDM (Type I and II)
  - ✓ $\tan\beta$-m_H plan constraints: typically small $\tan\beta$ and constructive enhancement
- Model V: SUSY (chargino, MFV)
  - ✓ Destructive contribution possible

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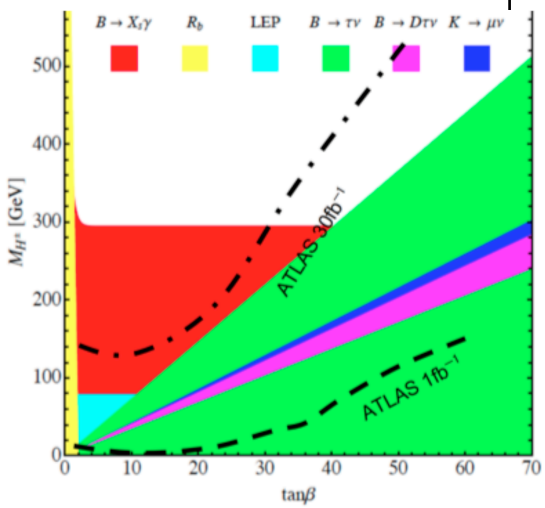

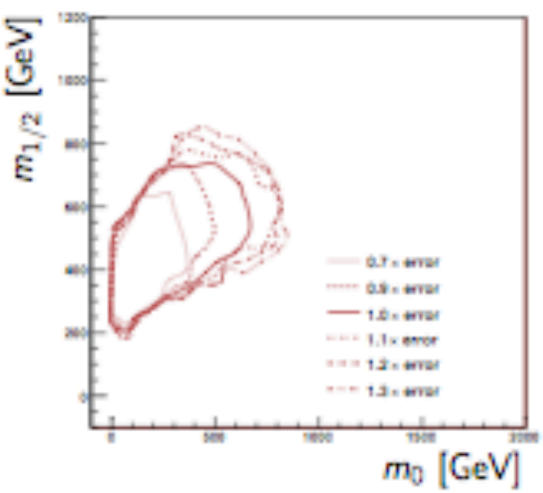

- Model VI: Triplet Higgs
- Model VII: Extended Techincolor
- Model VIII: Leptoquark
- Model IX: Left-Right symmetric model
- Model X: 4th generation

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- Model VIII: Leptoquark
- Model IX: Left-Right symmetric model
- Model X: 4th generation

Lepton flavour violation to be included (it is not discussed much in Babar book, maybe because it was before Neutrino mass discovery?).

NEW

Outline of Section 22.2

- Subsection 22.2: Benchmark "new physics" models
  - Subsection 22.2.1: Historical view (1-2 pages):

    CP--Before/After KM ansatz mixing, Baryogenesis, flavour predictions of m_t, m_c..., relation to neutrino
  - Subsection 22.2.2: Benchmark Models (5-6 pages):

Approximate CP, SUSY (MFV, non-MFV), RS, 4SM, 2HDM
  - Subsection 22.2.3: Look into the future (1-2 pages):

Polarization, LFV (τ decay).....

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Need Coordination with Section 13

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