A possible outline for the "flavor chapter" of WG3

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▶ Motivation
  (*role of flavor in constraining NP*)

▶ Status of the art
  (*discussion of present "anomalies"*)

▶ General classification of NP models
  (*as far as low-energy flavor physics is concerned*)

▶ <u>Minimal</u> list of key observables

▶ Future exp. prospects for the key observables

▶ <u>Motivation</u> (*role of low-energy flavor in constraining NP*)

General decomposition of flavor-violating observables:

$$A = A_0 \left[c_{SM} \frac{1}{M_W{}^2} + c_{NP} \frac{1}{\Lambda^2} \right]$$

⬇

• Potential sensitivity up to very high NP scales

• No way to disentangle Λ & c_{NP}, but the combined information which can be extracted is <u>fully complementary</u> to direct searches at high-p_T: <u>flavor-symmetry structure of NP</u>

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- The interest of a given flavor obs. depends on the magnitude of c_{SM} vs. c_{NP} and on the theoretical error of c_{SM} =>   <u>concentrate on th. clean or rare processes</u> (*very long lists of observables often misleadings*)

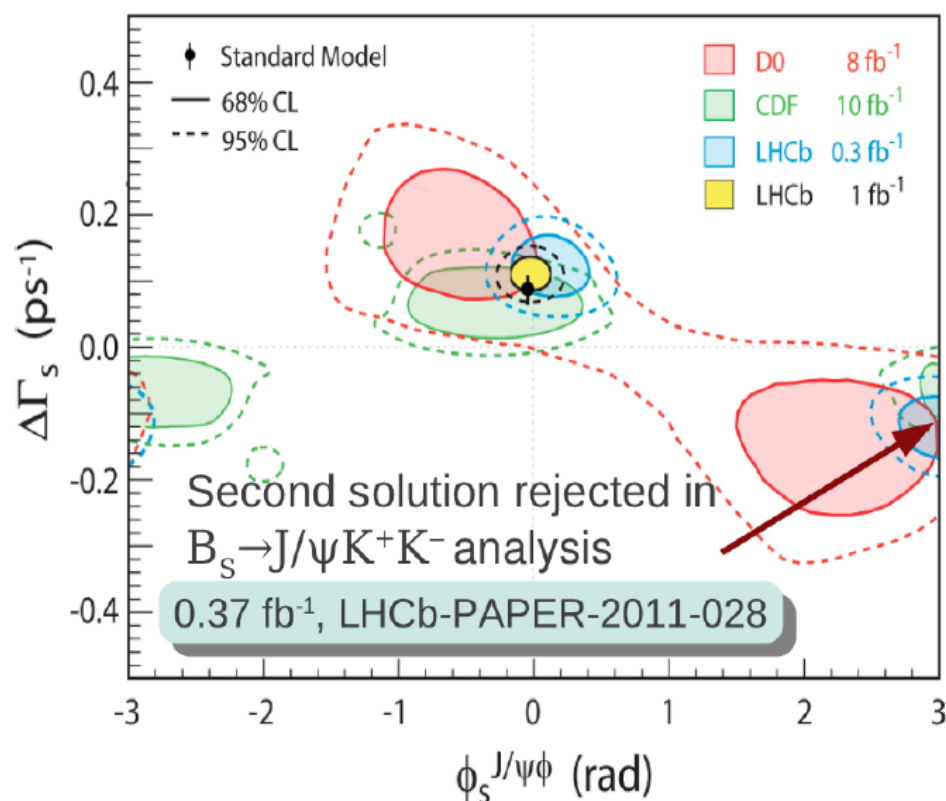▶ <u>Status of the art</u> (*discussion of present "anomalies"*)
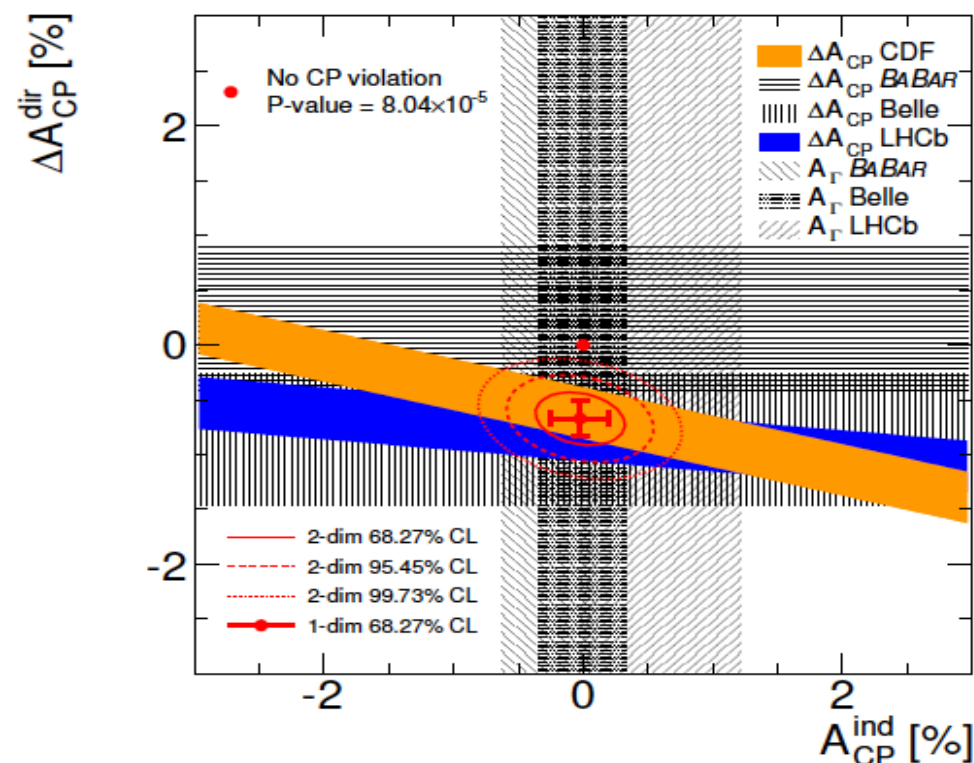
- Overall good consistency of the SM
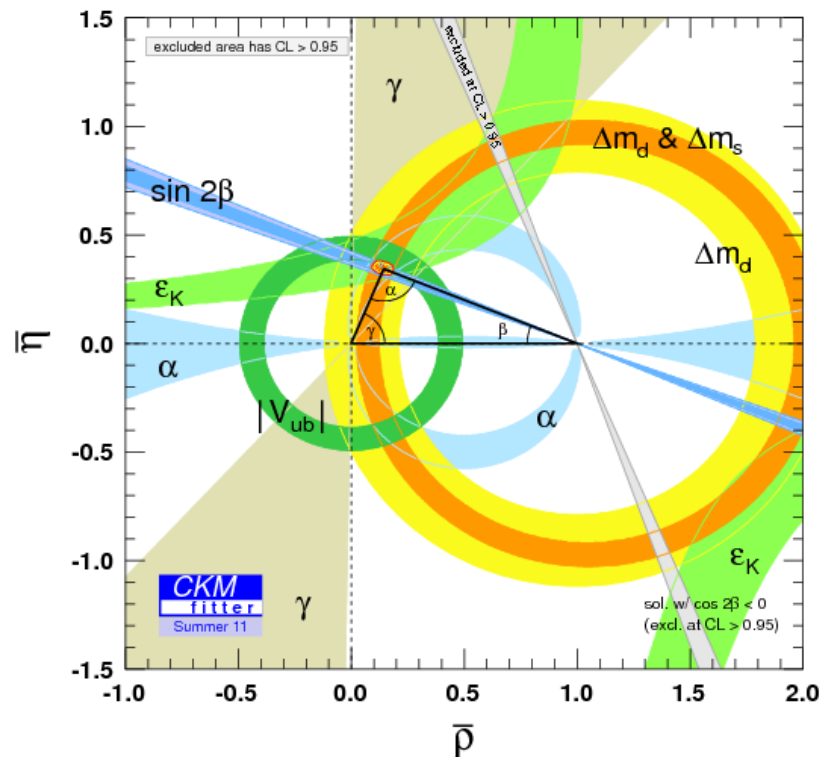
We need to stress there is much more that is not shown in the usual CKM plots (ϕ_s, $B_s \rightarrow \mu\mu$, etc...)

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- Key role of LHCb (& CDF) in b→ s physics (ϕ_s, B_s→μμ, B→K*ll) and Charm [*substantial change of paradigm with respect to ~ 2 years ago*]:
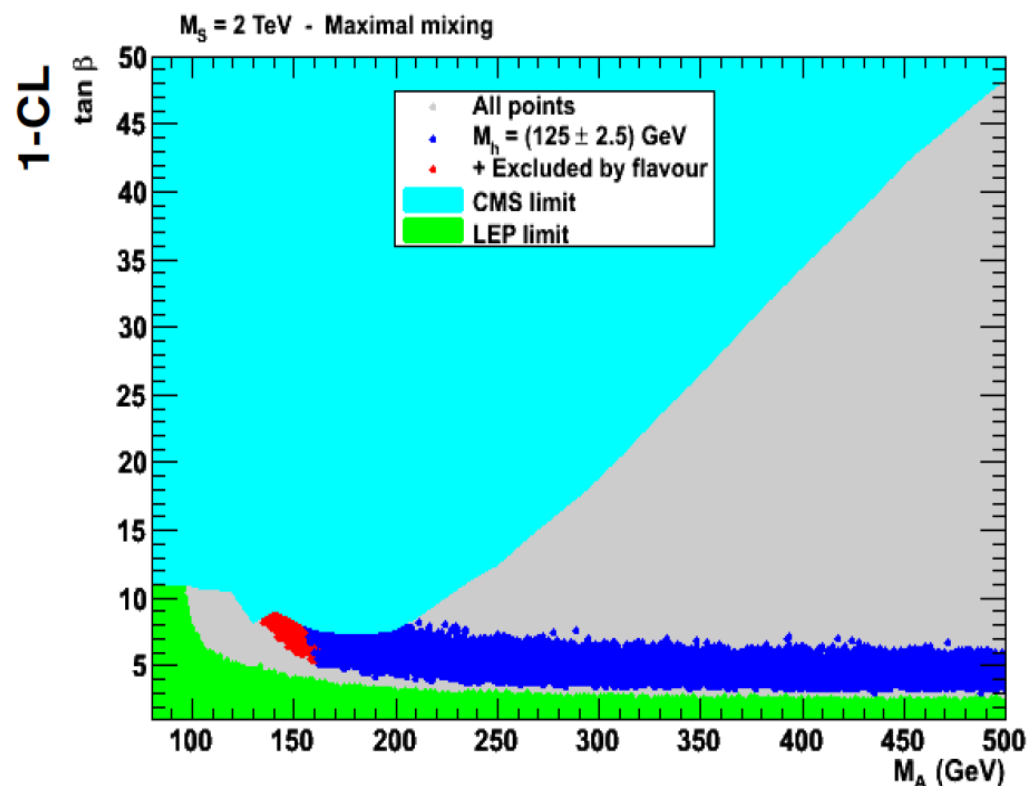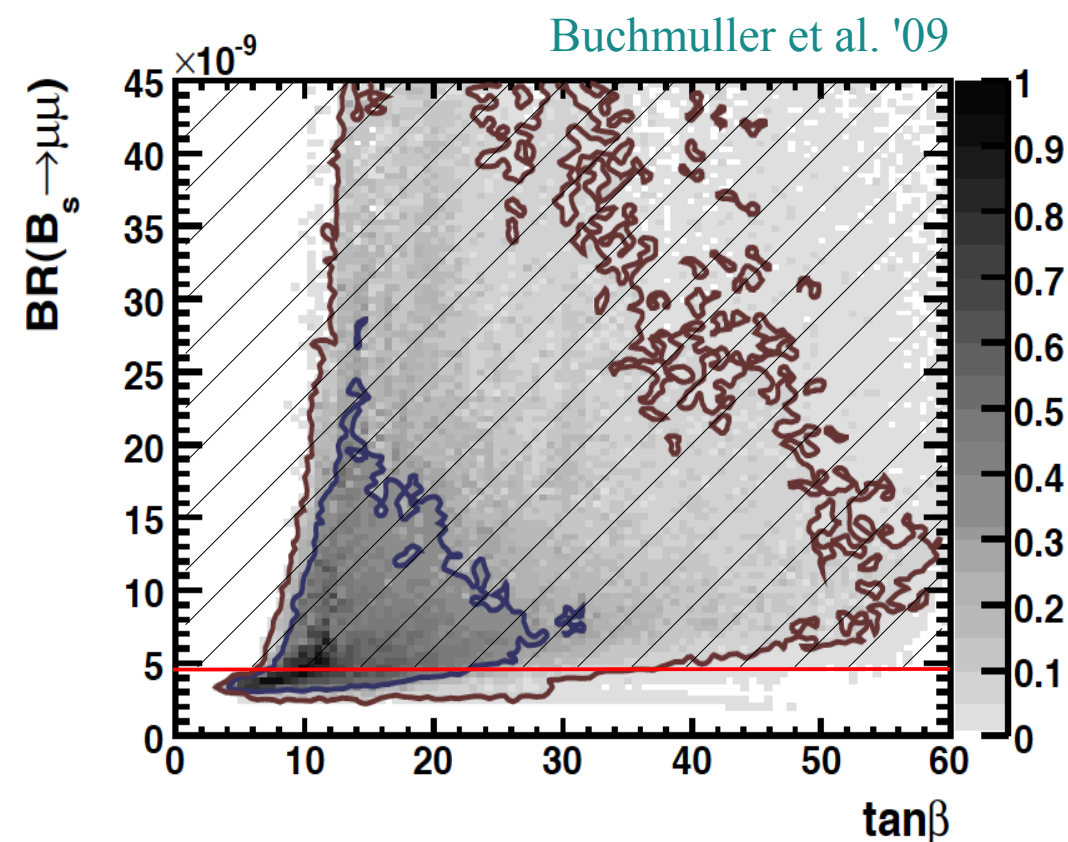

→ Blake's talk   → Spradlin's talk

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Buchmuller et al. '09

→ Djouadi's talk

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- Two key open issues at present:

  I. *The "old" CKM anomaly*

  II. *The recent puzzle of CPV in charm*

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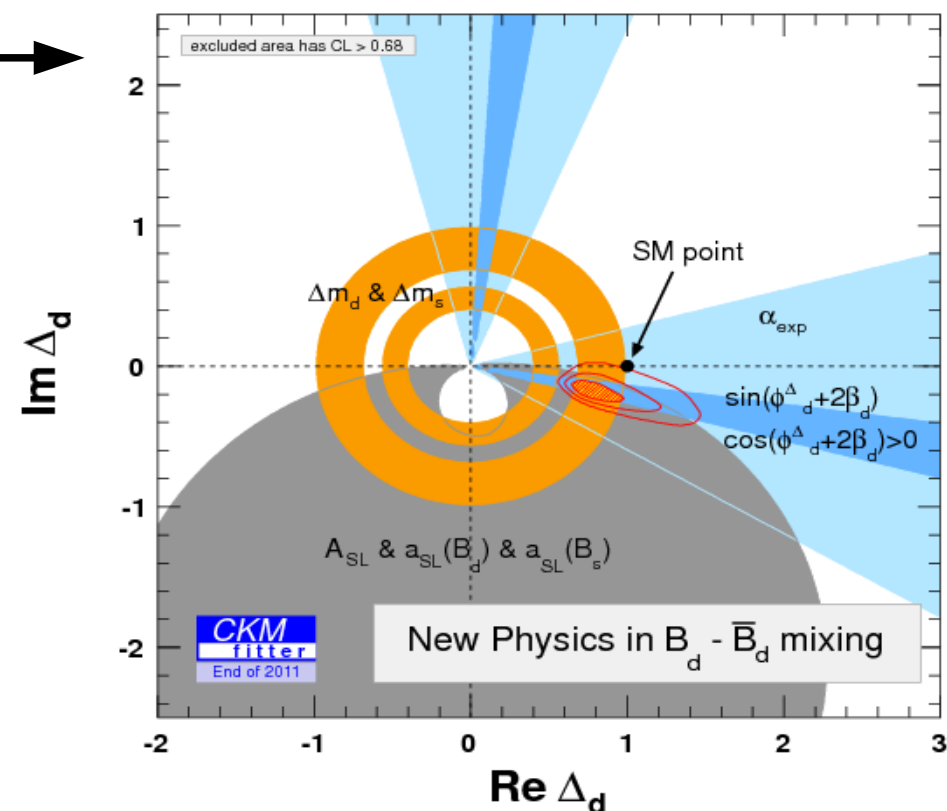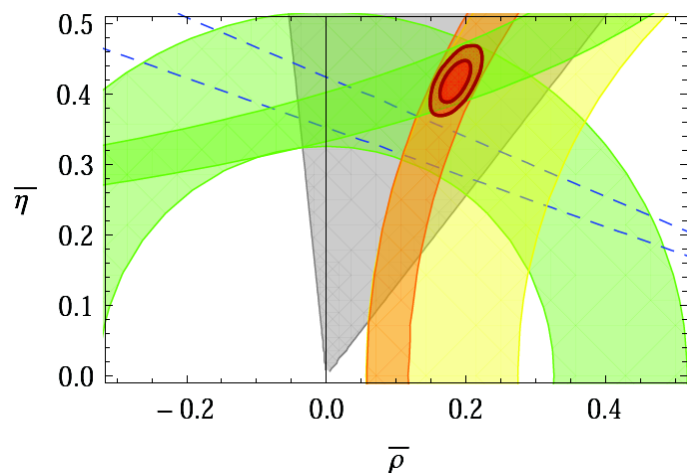 II. *The recent puzzle of CPV in charm*

Need to improve the determination of γ and V_{ub} :

II. *The "recent" puzzle of CPV in charm:*

- Clearly need to study charm system in detail. A lot more to do for LHCb!
    - All measurements being improved with larger data sets in hand. 2012 will at least double that.
    - We are undertaking a comprehensive program in a variety of channels, using alternative analysis methods/trigger paths for *CP* searches. More soon!
    - Continue to investigate charm loops in a variety of ways, such as rare decays.

- LHCb thanks all of the theorists working to interpret our results!
    - We crave feedback. What measurements are most interesting to the theory community?

- Lots of precision charm results to come. Will calculations match precision?

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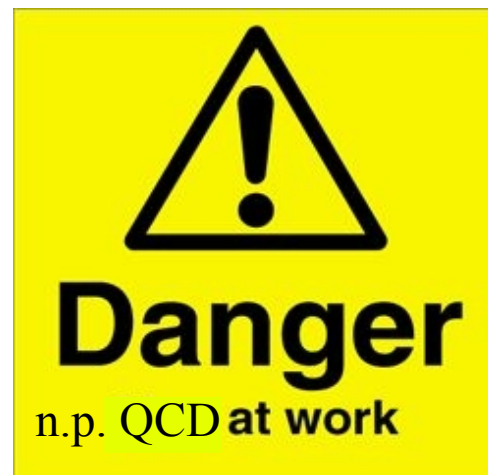WORK IN PROGRESS

⚠ **Danger**

n.p. QCD at work

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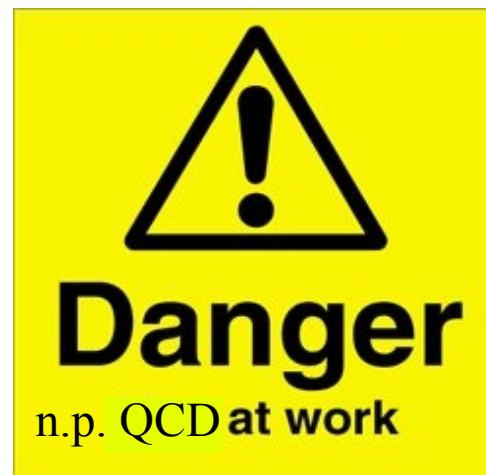

Danger

n.p. QCD at work

I'm confident some progress will be made in the next new few months...

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Two main classes

MFV-like   non -MFV

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- In several realistic cases the most significant effects are expected in $2^{nd} \rightarrow 1^{st}$ transitions, either in the down sector (Kaon physics) or in the up sector (CPV in charm).

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Only SM Y's   Flavor-blind CP
no new CPV $U(2)^3$, ...

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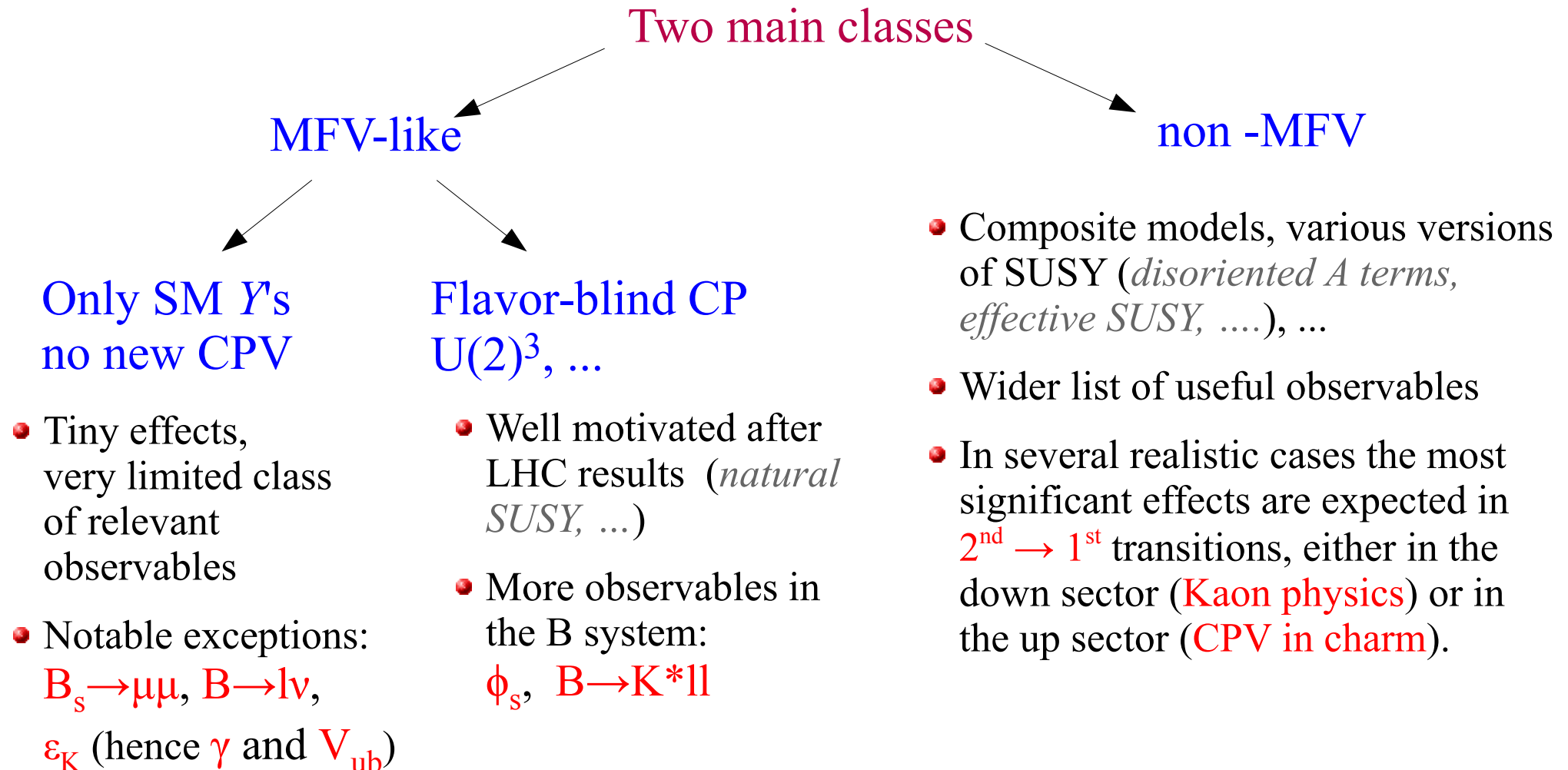
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E.g.: Natural (=split family) SUSY with $U(2)^3$

Contribution to B_b mix. reducing the present CKM tension

Barbieri *et al.*, '11
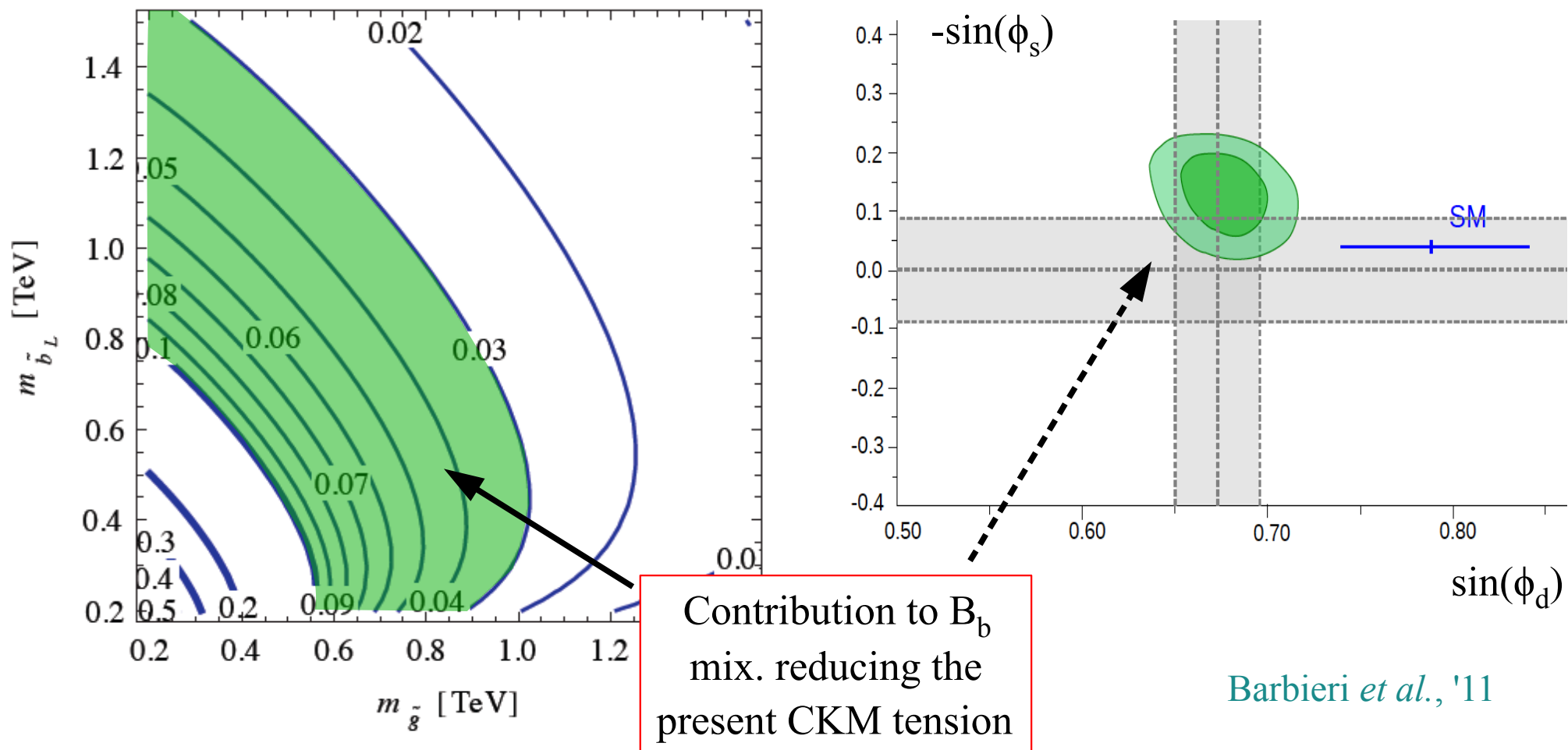
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[<u>again feedback is
very welcome...!!</u>]

- γ from tree (B $\to$ DK, ...)

- $|V_{ub}|$ from semi-leptonic B decays

- $B_{s,d} \to l^+ l^-$

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- $B \to K^{(*)} l^+ l^-, \nu\nu$

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- LFV in charged leptons   →   Shall we discuss it ? … probably Yes

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- γ from tree (B $\to$ DK, ...)   (S)LHCb

- $|V_{ub}|$ from semi-leptonic B decays   SuperB's

- $B_{s,d} \to l^+l^-$ (S)LHCb

- CPV in B_s mixing   (S)LHCb

- B $\to$ K$^{(*)}$ l^+l^-, $\nu\nu$ (S)LHCb , SuperB's

- B $\to$ $\tau\nu$, $\mu\nu$ SuperB's

- K $\to$ $\pi\nu\nu$ Kaon beams (NA62,...)

- CPV in charm   (S)LHCb , SuperB's

- LFV in charged leptons   Muon beams, (S)LHCb, SuperB's