Symmetries and Standard Model Tests in B→DD

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INTRO

- Strong evidence for Physics beyond the Standard Model (SM)
- CP Violation (CPV) is too small to explain Baryon Asymmetry
- In new physics theories, we generally expect $\mathcal{O}(1)$ weak phases ⇒ significant CPV

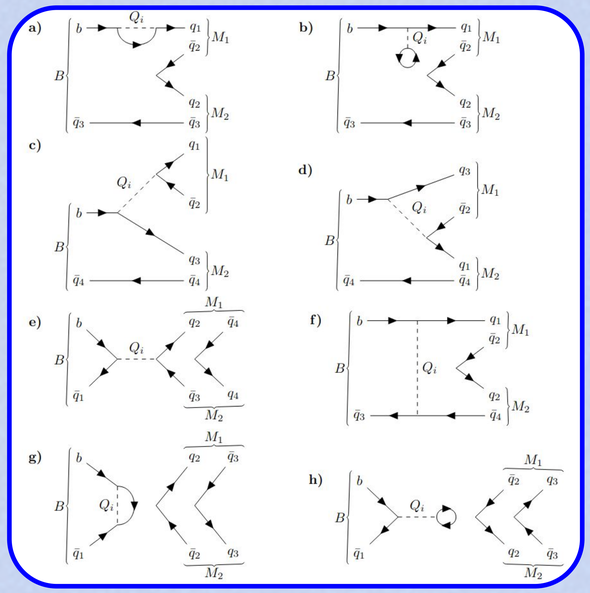
AIMS

1. Assess the consistency of the SM with most recent experimental data
2. Predict unmeasured observables
3. Check validity of SU(3) Symmetry

METHODS

- Expand in $(m_s-m_d)/\Lambda_{QCD}$
- Express Amplitudes in terms of SU(3) matrix elements or topologies (see right)
- Apply first-order perturbations
- Construct χ^2 with current experimental data
- Profiled minimisation to extract observable predictions from symmetries

TOPOLOGIES



Available set of topological diagrams for B → DD Decays

DECOMPOSITION

Mode	$\lambda_{cD}T$	$\lambda_{cD}A^c$	$\lambda_{uD}\tilde{P}_1$	$\lambda_{uD}\tilde{P}_3$	$\lambda_{uD}A_1^u$	$\lambda_{uD}A_2^u$
Counting	1	$\varepsilon^{1.5}$	$\varepsilon^{2.5}$	$\varepsilon^{3.5}$	$\varepsilon^{2.5}$	$\varepsilon^{3.5}$
1 $B^- \to D^- D^0$	1	0	−1	0	1	0
2 $B^- \to D_s^- D^0$	1	0	−1	0	1	0
3 $\bar{B}^0 \to D_s^- D^+$	1	0	−1	0	0	0
4 $\bar{B}_s \to D^- D_s^+$	1	0	−1	0	0	0
5 $\bar{B}^0 \to D^- D^+$	1	1	−1	−1	0	0
6 $\bar{B}_s \to D_s^- D_s^+$	1	1	−1	−1	0	0
7 $\bar{B}^0 \to D_s^- D_s^+$	0	1	0	−1	0	0
8 $\bar{B}_s \to D^- D^+$	0	1	0	−1	0	0
9 $\bar{B}^0 \to \bar{D}^0 D^0$	0	−1	0	1	0	−1
10 $\bar{B}_s \to \bar{D}^0 D^0$	0	−1	0	1	0	−1

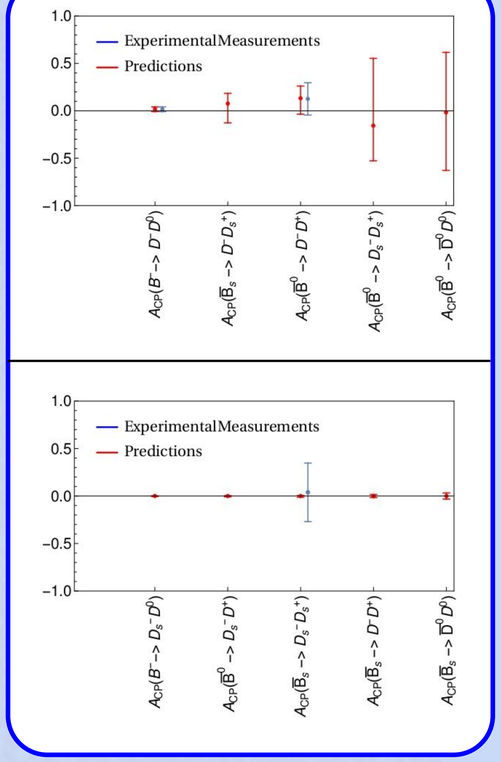
Decay amplitudes in terms of topological parameters with appropriate suppression

POWER COUNTING

We choose $\epsilon \sim 0.3$

- **CKM suppression- $\mathcal{O}(\epsilon)$:** Where CKM factors cannot be separated from the hadronic matrix elements.
- **SU(3) structure- $\mathcal{O}(\epsilon)$:** For SU(3)-breaking contributions
- **Colour suppression:** Relative counting in $1/N_C \sim \epsilon$ for the topologies, following Refs. 1-4.
- **Penguin suppression:**
  - Tree matrix elements of penguin operators- $\mathcal{O}(\epsilon^2)$
  - Penguin matrix elements of tree operators- $\mathcal{O}(\epsilon^{1/2})$
- **Annihilation: $\mathcal{O}(\epsilon^{1/2})$** for annihilation diagram + $\mathcal{O}(\epsilon)$ for $c\bar{c}$ creation.

(SOME) RESULTS



REFERENCES

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[3] Buras et al., doi:10/bnnssz
[4] Jung et al., doi:10/jpw9

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