# Flavor Physics Working Group (WG-II): Brief Summary

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## Primary focus areas

- Lepton flavor universality violation in $B \to D^{(*)}\tau\bar{\nu}$ decays
- Probing new physics via FCNC decays induced by $b \to s l^+ l^-$
- Prospects of various new physics models in light of recent anomalies in $B$-sector
- New physics in lepton number violating tau and muon decays
- CP violation in $B$ and $D$ decays and mixing
- Role of $K$ decays in probing new physics
- Hadron spectroscopy

We started in the background of many anomalies in the $B$ sector:

$$R_K = \frac{\mathcal{B}(B\to K\mu^+\mu^-)_{[q^2\in[1-6]]}}{\mathcal{B}(B\to Ke^+e^-)_{[q^2\in[1-6]]}};\ [\mathbf{2.6}]\sigma$$ *[LHCb 14]*

$$R_{K^*low} = \frac{\mathcal{B}(B\to K^*\mu^+\mu^-)_{[q^2\in[0.045-1.1]]}}{\mathcal{B}(B\to K^*e^+e^-)_{[q^2\in[0.045-1.1]]}};\ [\mathbf{2.2}-\mathbf{2.4}]\sigma$$ *[LHCb 17]*

$$R_{K^*cen} = \frac{\mathcal{B}(B\to K^*\mu^+\mu^-)_{[q^2\in[1.1-6]]}}{\mathcal{B}(B\to K^*e^+e^-)_{[q^2\in[1.1-6]]}};\ [\mathbf{2.4}-\mathbf{2.5}]\sigma$$ *[LHCb 17]*

$$R_D = \frac{\mathcal{B}(\bar{B}\to D\tau^-\bar{\nu})}{\mathcal{B}(\bar{B}\to D\ell^-\bar{\nu})};\ \mathbf{2.3}\sigma$$ *[BaBar 12 13, Belle 15 16 17, LHCb 15 17]*

$$R_{D^*} = \frac{\mathcal{B}(\bar{B}\to D^*\tau^-\bar{\nu})}{\mathcal{B}(\bar{B}\to D^*\ell^-\bar{\nu})};\ \mathbf{3.4}\sigma$$ *[BaBar 12 13, Belle 15 16 17, LHCb 15 17]*

$\mathcal{B}(B_s \to \phi\mu^+\mu^-)$; $\mathbf{3.5}\sigma$ *[LHCb 13, 15]*

$B \to K^*\mu^+\mu^-$ *angular observable* $P_5'$; $\sim \mathbf{4.0}\sigma$ *[LHCb 13, 15, Belle 16, CMS, ATLAS 17 ]*

An overview of these anomalies were provided by **Rukmani Mohanta**, **Jonas Rademacker** , **David London** and **Jacky Kumar**.

# Model independent resolution

$\mathbf{b \to s}$ : $C_9^\mu = (\bar{s}\gamma_\mu P_L b)(\bar{\mu}\gamma^\mu \mu), \quad C_{10}^\mu = (\bar{s}\gamma_\mu P_L b)(\bar{\mu}\gamma^\mu \gamma_5 \mu)$

**Global fits**: $C_9^\mu = -C_{10}^\mu$ **i.e a (V-A) form as in SM!**

$\mathbf{b \to c}$ : $C_L = (\bar{c}\gamma^\mu P_L b)(\bar{\tau}\gamma_\mu P_L \nu)$

# Model dependent resolutions

*Possible new mediators: $Z'$, $W'$, Leptoquarks, Scalars*

*Solution only to $R_{K^{(*)}}$* :

*(1) SM-like VB (2) Scalar triplet LQ (3) Vector triplet LQ (4) Vector singlet LQ*

*Global fits to $b \to s\ell\ell$ data $\Longrightarrow$ 2, 3 and 4 are proven to be good candidates.*

*Combined explanation to $R_K^{(*)}$ and $R_{D^{(*)}}$:*

*(1) SM-like VB: disfavored by $B(\tau \to 3\mu)$ upper bound*

*(2) Scalar triplet LQ: can not explain $R_D^{(*)}$*

*(3) Vector triplet LQ: can not explain $R_D^{(*)}$*

*(4) Vector singlet LQ: a viable candidate !*

An overview of $CP$ violation in $B$ and $D$ decays and mixing was provided by **Anjan Giri**.

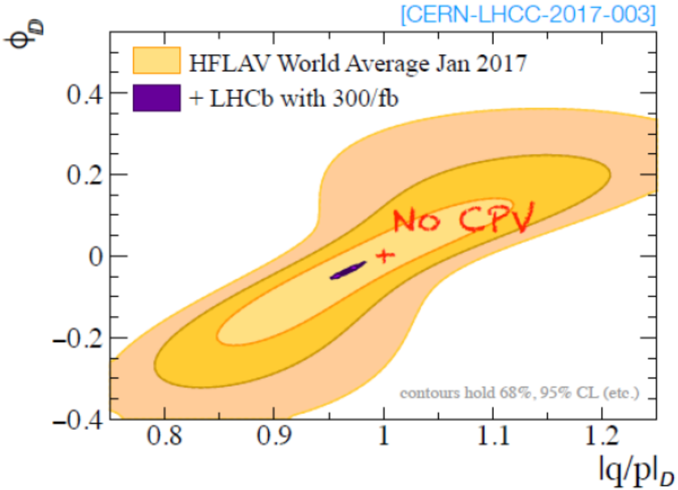
## Unitarity Triangle analysis in the SM:

obtained excluding the given constraint from the fit (→ Prediction)

| Observables | Measurement | Prediction | Pull (#σ) |
|---|---|---|---|
| $\sin 2\beta$ | 0.670 ± 0.022 | 0.740 ± 0.032 | ~ 1.8 |
| $\gamma$ | 70.5 ± 5.7 | 65.6 ± 2.2 | < 1 |
| $\alpha$ | 94.2 ± 4.5 | 91.0 ± 2.5 | < 1 |
| $\lvert V_{ub}\rvert \cdot 10^3$ | 3.74 ± 0.23 | 3.61 ± 0.12 | < 1 |
| $\lvert V_{ub}\rvert \cdot 10^3$ (incl) | 4.50 ± 0.20 | - | ~ 3.8 ← |
| $\lvert V_{ub}\rvert \cdot 10^3$ (excl) | 3.65 ± 0.14 | - | < 1 |
| $\lvert V_{cb}\rvert \cdot 10^3$ | 40.5 ± 1.1 | 42.7 ± 0.7 | ~ 1.7 |
| $BR(B \to \tau\nu)[10^{-4}]$ | 1.06 ± 0.19 | 0.79 ± 0.06 | ~ 1.3 |
| $A_{SL}^{d} \cdot 10^3$ | -2.1 ± 1.7 | -0.289 ± 0.027 | ~ 1 |
| $A_{SL}^{s} \cdot 10^3$ | -0.6 ± 2.8 | 0.013 ± 0.001 | < 1 |

M Bona, EPS 2017

An overview of $CP$ violation in $B$ and $D$ decays and mixing was provided by **Anjan Giri**.



An overview of $K$ meson physics was provided by **Girish Kumar**.

Kaon sector has played a major role in helping understand the underlying flavour structure of the Standard Model.

Key role in precision test of CKM unitarity

Largest GIM, CKM suppression; very rare; generally most sensitive to NP effects

$$\underbrace{V_{ts}^* V_{td}}_{\text{K system}} \sim 5 \cdot 10^{-4} \ll \underbrace{V_{tb}^* V_{td}}_{B_d \text{ system}} \sim 10^{-2} < \underbrace{V_{tb}^* V_{ts}}_{B_s \text{ system}} \sim 4 \cdot 10^{-2}$$

Some of most stringent constraints on new physics comes from K sector

$\epsilon'/\epsilon$ : Measure of direct CPV in $K \to 2\pi$

At present, there is a about 3 sigma discrepancy in the SM prediction and the value calculated using from lattice QCD and dual QCD approaches.

NA48, KTeV Collab., see PDG 2016; PRL 115, 212001, JHEP 12 (2016) 078, JHEP 11 (2015) 202

There are hints of CPV beyond the SM. Further progress in lattice calculations will be crucial to confirm if this is really the hint of CPV beyond the SM.

**Experimentally:** $BR(K_L \to \pi^0 \nu \bar{\nu}) \leq 2.6 \times 10^{-8}$ E949 Collab. 0808.2459

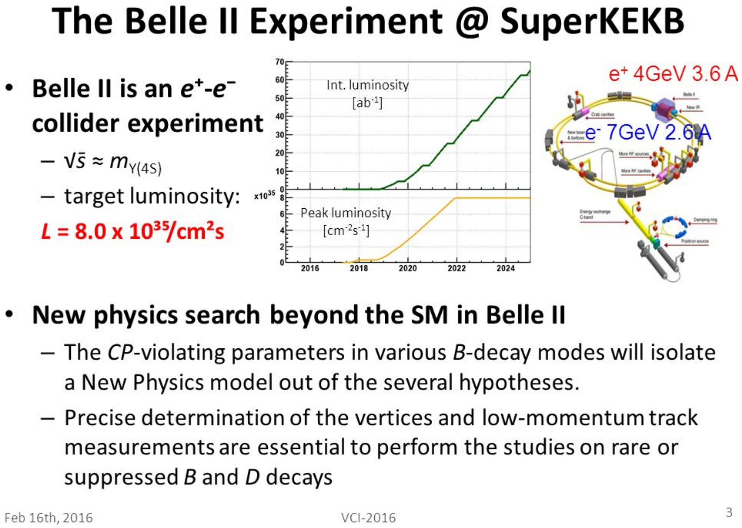
$BR(K^+ \to \pi^+ \nu \bar{\nu}) = (17.3 \pm 11) \times 10^{-11}$ E391a Collab. 0911.4789

An overview of hadron spectroscopy was provided by **Zalak Shah** and **Nairit Sur**.

- The hadron spectroscopy have been studied in light, heavy-light and heavy-heavy sector for Mesons, Baryons and the exotic states theoretically as well as experimentally[a]. & many more doubly and triply heavy baryons are expected to detect from future experiments.
- The theoretical predictions for the Hadronic states are given by: Lattice QCD, QCD Sum rule, HQET, various quarks models.
- The radial and orbital excited states masses (from S state to F state) are predicted by Hypercentral Constituent Quark Model(hCQM)[b] for heavy flavored baryons.
- The regge trajectories are plotted in (n, $M^2$) and (J, $M^2$) planes. They are useful to determine the unknown states and assigned $J^P$ values.
- The charmonium system has well-predicted spectrum and distinct properties (zero-charge, zero-strangeness, constrained decay transitions) and is suitable for searching exotic charged states like Z(4430) with a quark content $|c\bar{c}d\bar{u}\rangle$ (Belle : PhysRevD.88.074026 , LHCb : PhysRevLett.112.222002)
- In Amplitude Analysis approach for Z(4430) analysis, the amplitudes of B decays are written in the helicity formalism and calculated minimally in a 4-Dimentional $(M^2_{K\pi}, M^2_{\psi\pi}, \theta_\psi, \phi)$ space. The helicity amplitude (H) of the dominant intermediate resonance is taken as $|H| = 1$ and $arg(H) = 0$ and the helicity amplitudes of all the others are obtained by fitting to data. This is a computationally intensive exercise and advanced techniques have been developed for this purpose

[a] JHEP **1705**,030 (2017); PRL **118**, 182001 (2017); PRL **119**, 112001 (2017)
[b] CPC **40**, 123102 (2016); EPJA **52**, 313 (2016);EPJC **77**, 129 (2017).

An overview of flavor physics prospectives of Belle-II were provided by **Gagan Mohanty**, **Niladribihari Sahoo** and **Prasanth Krishnan**.



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| Observables | Expected th. accuracy | Expected exp. uncertainty | Facility (2025) |
|---|---|---|---|
| UT angles & sides | | | |
| $\phi_1$ [°] | *** | 0.4 | Belle II |
| $\phi_2$ [°] | ** | 1.0 | Belle II |
| $\phi_3$ [°] | *** | 1.0 | Belle II/LHCb |
| $\lvert V_{cb}\rvert$ incl. | *** | 1% | Belle II |
| $\lvert V_{cb}\rvert$ excl. | *** | 1.5% | Belle II |
| $\lvert V_{ub}\rvert$ incl. | ** | 3% | Belle II |
| $\lvert V_{ub}\rvert$ excl. | ** | 2% | Belle II/LHCb |
| CPV | | | |
| $S(B \to \phi K^0)$ | *** | 0.02 | Belle II |
| $S(B \to \eta' K^0)$ | *** | 0.01 | Belle II |
| $\mathcal{A}(B \to K^0\pi^0)[10^{-2}]$ | *** | 4 | Belle II |
| $\mathcal{A}(B \to K^+\pi^-)$ $[10^{-2}]$ | *** | 0.20 | LHCb/Belle II |
| (Semi-)leptonic | | | |
| $\mathcal{B}(B \to \tau\nu)$ $[10^{-6}]$ | ** | 3% | Belle II |
| $\mathcal{B}(B \to \mu\nu)$ $[10^{-6}]$ | ** | 7% | Belle II |
| $R(B \to D\tau\nu)$ | *** | 3% | Belle II |
| $R(B \to D^*\tau\nu)$ | *** | 2% | Belle II/LHCb |
| Radiative & EW Penguins | | | |
| $\mathcal{B}(B \to X_s\gamma)$ | ** | 4% | Belle II |
| $A_{CP}(B \to X_{s,d}\gamma)$ $[10^{-2}]$ | *** | 0.005 | Belle II |
| $S(B \to K_S^0\pi^0\gamma)$ | *** | 0.03 | Belle II |
| $S(B \to \rho\gamma)$ | ** | 0.07 | Belle II |
| $\mathcal{B}(B_s \to \gamma\gamma)$ $[10^{-6}]$ | ** | 0.3 | Belle II |
| $\mathcal{B}(B \to K^*\nu\overline{\nu})$ $[10^{-6}]$ | *** | 15% | Belle II |
| $\mathcal{B}(B \to K\nu\overline{\nu})$ $[10^{-6}]$ | *** | 20% | Belle II |
| $R(B \to K^*\ell\ell)$ | ** | 0.03 | Belle II/LHCb |

| | Observables | Belle or LHCb* | Belle II | | LHCb | |
|---|---|---|---|---|---|---|
| | | (2014) | 5 $ab^{-1}$ | 50 $ab^{-1}$ | 2018 | 50 $fb^{-1}$ |
| Charm Rare | $\mathcal{B}(D_s \to \mu\nu)$ | $5.31 \cdot 10^{-3}(1 \pm 5.3\% \pm 3.8\%)$ | 2.9% | 0.9% | | |
| | $\mathcal{B}(D_s \to \tau\nu)$ | $5.70 \cdot 10^{-3}(1 \pm 3.7\% \pm 5.4\%)$ | 3.5% | 2.3% | | |
| | $\mathcal{B}(D^0 \to \gamma\gamma)$ $[10^{-6}]$ | $< 1.5$ | 30% | 25% | | |
| Charm $CP$ | $A_{CP}(D^0 \to K^+K^-)$ $[10^{-4}]$ | $-32 \pm 21 \pm 9$ | 11 | 6 | | |
| | $\Delta A_{CP}(D^0 \to K^+K^-)$ $[10^{-3}]$ | 3.4* | | | 0.5 | 0.1 |
| | $A_\Gamma$ $[10^{-2}]$ | 0.22 | 0.1 | 0.03 | 0.02 | 0.005 |
| | $A_{CP}(D^0 \to \pi^0\pi^0)$ $[10^{-2}]$ | $-0.03 \pm 0.64 \pm 0.10$ | 0.29 | 0.09 | | |
| | $A_{CP}(D^0 \to K_S^0\pi^0)$ $[10^{-2}]$ | $-0.21 \pm 0.16 \pm 0.09$ | 0.08 | 0.03 | | |
| Charm Mixing | $x(D^0 \to K_S^0\pi^+\pi^-)$ $[10^{-2}]$ | $0.56 \pm 0.19 \pm {}^{0.07}_{0.13}$ | 0.14 | 0.11 | | |
| | $y(D^0 \to K_S^0\pi^+\pi^-)$ $[10^{-2}]$ | $0.30 \pm 0.15 \pm {}^{0.05}_{0.08}$ | 0.08 | 0.05 | | |
| | $\lvert q/p\rvert(D^0 \to K_S^0\pi^+\pi^-)$ | $0.90 \pm {}^{0.16}_{0.15} \pm {}^{0.08}_{0.06}$ | 0.10 | 0.07 | | |
| | $\phi(D^0 \to K_S^0\pi^+\pi^-)$ [°] | $-6 \pm 11 \pm {}^{4}_{5}$ | 6 | 4 | | |
| Tau | $\tau \to \mu\gamma$ $[10^{-9}]$ | $< 45$ | $< 14.7$ | $< 4.7$ | | |
| | $\tau \to e\gamma$ $[10^{-9}]$ | $< 120$ | $< 39$ | $< 12$ | | |
| | $\tau \to \mu\mu\mu$ $[10^{-9}]$ | $< 21.0$ | $< 3.0$ | $< 0.3$ | | |

An overview of flavor physics prospectives of Belle-II were provided by **Gagan Mohanty**, **Niladribihari Sahoo** and **Prasanth Krishnan**.

Expected uncertainties on several selected flavor observables with an integrated luminosity of 5 $ab^{-1}$ and 50 $ab^{-1}$ of Belle II data

| | Observables | Belle (2014) | Belle II 5 $ab^{-1}$ | Belle II 50 $ab^{-1}$ |
|---|---|---|---|---|
| UT angles | $\sin 2\beta$ | $0.667 \pm 0.023 \pm 0.012$ [56] | 0.012 | 0.008 |
| | $\alpha$ [°] | $85 \pm 4$ (Belle+BaBar) [24] | 2 | 1 |
| | $\gamma$ [°] | $68 \pm 14$ [13] | 6 | 1.5 |
| Gluonic penguins | $S(B \to \phi K^0)$ | $0.90^{+0.09}_{-0.19}$ [19] | 0.053 | 0.018 |
| | $S(B \to \eta' K^0)$ | $0.68 \pm 0.07 \pm 0.03$ [57] | 0.028 | 0.011 |
| | $S(B \to K_S^0 K_S^0 K_S^0)$ | $0.30 \pm 0.32 \pm 0.08$ [17] | 0.100 | 0.033 |
| | $\mathcal{A}(B \to K^0 \pi^0)$ | $-0.05 \pm 0.14 \pm 0.05$ [58] | 0.07 | 0.04 |
| UT sides | $\|V_{cb}\|$ incl. | $41.6 \cdot 10^{-3}(1 \pm 1.8\%)$ [8] | 1.2% | |
| | $\|V_{cb}\|$ excl. | $37.5 \cdot 10^{-3}(1 \pm 3.0\%_{ex.} \pm 2.7\%_{th.})$ [10] | 1.8% | 1.4% |
| | $\|V_{ub}\|$ incl. | $4.47 \cdot 10^{-3}(1 \pm 6.0\%_{ex.} \pm 2.5\%_{th.})$ [5] | 3.4% | 3.0% |
| | $\|V_{ub}\|$ excl. (had. tag.) | $3.52 \cdot 10^{-3}(1 \pm 9.5\%)$ [7] | 4.4% | 2.3% |
| Missing $E$ decays | $\mathcal{B}(B \to \tau\nu)$ $[10^{-6}]$ | $96(1 \pm 27\%)$ [26] | 10% | 5% |
| | $\mathcal{B}(B \to \mu\nu)$ $[10^{-6}]$ | $< 1.7$ [59] | 20% | 7% |
| | $R(B \to D\tau\nu)$ | $0.440(1 \pm 16.5\%)$ [29]$^\dagger$ | 5.2% | 3.4% |
| | $R(B \to D^*\tau\nu)^\dagger$ | $0.332(1 \pm 9.0\%)$ [29]$^\dagger$ | 2.9% | 2.1% |
| | $\mathcal{B}(B \to K^{*+}\nu\bar{\nu})$ $[10^{-6}]$ | $< 40$ [31] | $< 15$ | 20% |
| | $\mathcal{B}(B \to K^+\nu\bar{\nu})$ $[10^{-6}]$ | $< 55$ [31] | $< 21$ | 30% |
| Rad. & EW penguins | $\mathcal{B}(B \to X_s\gamma)$ | $3.45 \cdot 10^{-4}(1 \pm 4.3\% \pm 11.6\%)$ | 7% | 6% |
| | $A_{CP}(B \to X_{s,d}\gamma)$ $[10^{-2}]$ | $2.2 \pm 4.0 \pm 0.8$ [60] | 1 | 0.5 |
| | $S(B \to K_S^0 \pi^0 \gamma)$ | $-0.10 \pm 0.31 \pm 0.07$[20] | 0.11 | 0.035 |
| | $S(B \to \rho\gamma)$ | $-0.83 \pm 0.65 \pm 0.18$ [21] | 0.23 | 0.07 |
| | $C_7/C_9$ $(B \to X_s\ell\ell)$ | ~20% [37] | 10% | 5% |
| | $\mathcal{B}(B_s \to \gamma\gamma)$ $[10^{-6}]$ | $< 8.7$ [40] | 0.3 | – |
| | $\mathcal{B}(B_s \to \tau\tau)$ $[10^{-3}]$ | – | $< 2$ [42]‡ | – |
| Charm Rare | $\mathcal{B}(D_s \to \mu\nu)$ | $5.31 \cdot 10^{-3}(1 \pm 5.3\% \pm 3.8\%)$ [44] | 2.9% | 0.9% |
| | $\mathcal{B}(D_s \to \tau\nu)$ | $5.70 \cdot 10^{-3}(1 \pm 3.7\% \pm 5.4\%)$ [44] | 3.5% | 3.6% |
| | $\mathcal{B}(D^0 \to \gamma\gamma)$ $[10^{-6}]$ | $< 1.5$ [47] | 30% | 25% |
| Charm $CP$ | $A_{CP}(D^0 \to K^+K^-)$ $[10^{-2}]$ | $-0.32 \pm 0.21 \pm 0.09$ [61] | 0.11 | 0.06 |
| | $A_{CP}(D^0 \to \pi^0\pi^0)$ $[10^{-2}]$ | $-0.03 \pm 0.64 \pm 0.10$ [62] | 0.29 | 0.09 |
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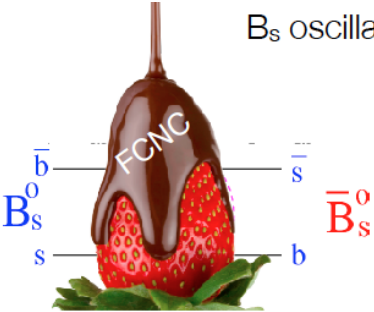
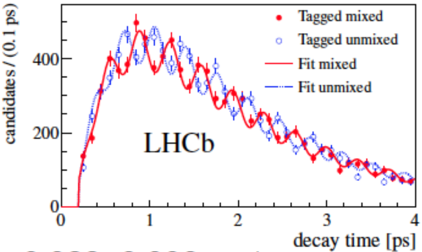
| | $\|q/p\|(D^0 \to K_S^0\pi^+\pi^-)$ | $0.90 \pm ^{0.16}_{0.15} \pm ^{0.08}_{0.06}$ [50] | 0.10 | 0.07 |
| | $\phi(D^0 \to K_S^0\pi^+\pi^-)$ [°] | $-6 \pm 11 \pm ^{4}_{5}$ [50] | 6 | 4 |
| Tau | $\tau \to \mu\gamma$ $[10^{-9}]$ | $< 45$ [63] | $< 14.7$ | $< 4.7$ |
| | $\tau \to e\gamma$ $[10^{-9}]$ | $< 120$ [63] | $< 39$ | $< 12$ |
| | $\tau \to \mu\mu\mu$ $[10^{-9}]$ | $< 21.0$ [64] | $< 3.0$ | $< 0.3$ |

*P. Urquijo / Nuclear and Particle Physics Proceedings 263–264 (2015) 15–23*

An overview of flavor physics prospectives of LHCb was provided by **Jonas Rademacker**.

## $B_s$ oscillations at LHCb




$\Delta m_s(\text{LHCb}) = 17.768 \pm 0.023 \pm 0.006\ \text{ps}^{-1}$

$\Delta m_s(\text{exp, world}) = 17.757 \pm 0.021\ \text{ps}^{-1}$

$\Delta m_s(\text{SM, 2015}) = 18.3 \pm 2.7\ \text{ps}^{-1}$

$\Delta m_s(\text{SM, 18/12/2017}) = 20.0 \pm 1.3\ \text{ps}^{-1}$

arXiv:1102.4274
arXiv:1712.06572

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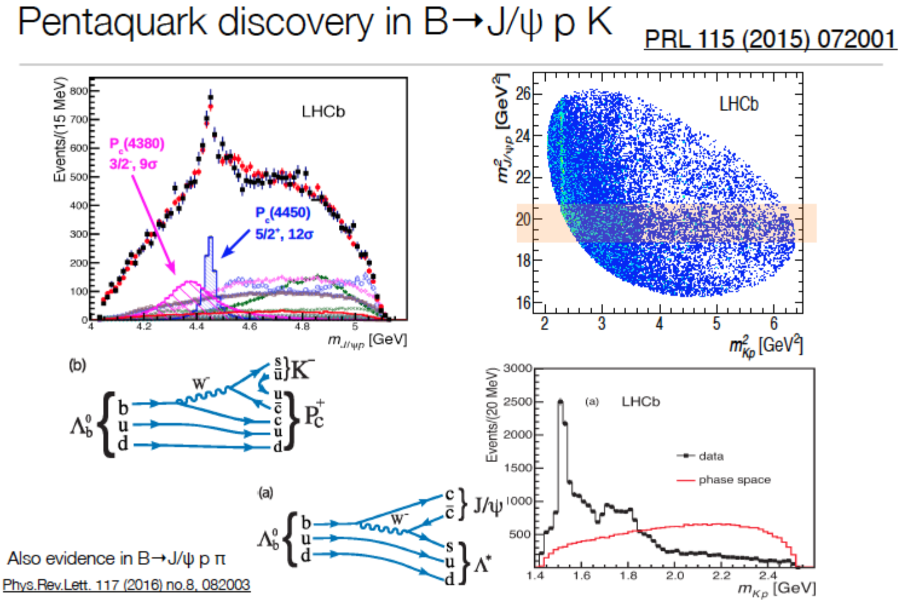

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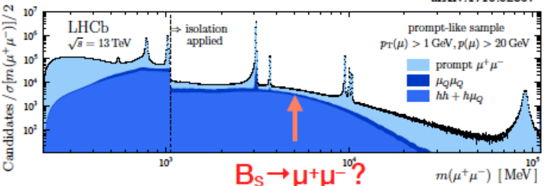
## $B_{(s)} \to \mu\mu$

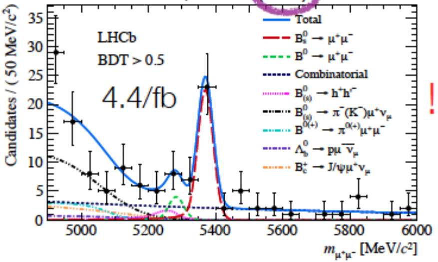
- Helicity-suppressed FCNC - very rare in SM!
- SM prediction [1]*:
  $BF(B_s \to \mu^+\mu^-) = (3.66 \pm 0.23) \cdot 10^{-9}$
  $BF(B_d \to \mu^+\mu^-) = (1.06 \pm 0.09) \cdot 10^{-10}$
- Large enhancements in many once popular SUSY models, $\propto \tan^6\beta$

arXiv:1710.02867




$B_s \to \mu^+\mu^-$?

LHCb: PRL 118, 191801 (2017)




$$\mathcal{B}(B_s^0 \to \mu^+\mu^-) = (3.0 \pm 0.6\,^{+0.3}_{-0.2}) \times 10^{-9}$$

$$\mathcal{B}(B^0 \to \mu^+\mu^-) < 3.4 \times 10^{-10} \text{ at } 95\%$$

(see also Nature 522 (2015) 68-72)
Combination of CMS & LHCb data

[1] PRL 112, 101801 (2014)
*) this BF refers to the time-integrated value, which differs from the one at t=0 due to the lifetime difference between the two $B_s$ mass eigenstates. See Phys. Rev. D 86, 014027 (2012).

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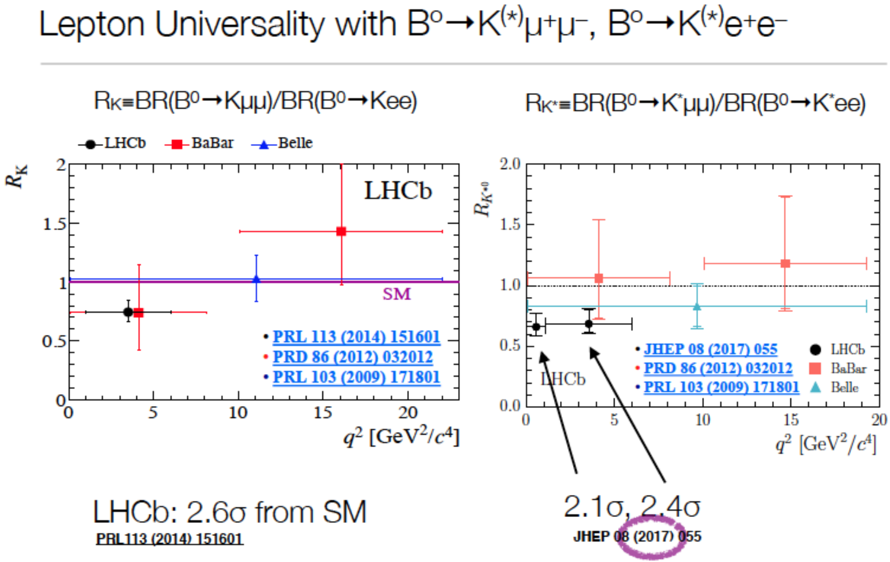

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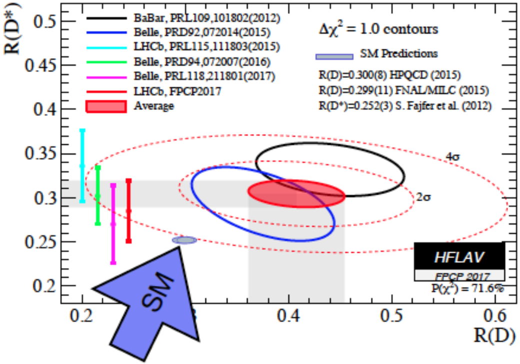
# R(D), R(D*)

$$\frac{\mathcal{B}(\bar{B}^0 \to D^{*+}\tau\bar{\nu})}{\mathcal{B}(\bar{B}^0 \to D^{*+}\mu\bar{\nu})}$$




~4σ deviation from SM*

*) excluding recent updates on R(D*), see arXiv:1707.09977 (2017) and JHEP 1711 (2017) 061, which find slightly larger values (0.257(5)-0.260(8))

# Talks

## Prospects of various new physics models in light of recent anomalies in B-sector

- *Overview talk*: Rukmani Mohanta
- *Models with vector-like fermions as a UV completion*: Gauhar Abbas
- *Lepton flavor non-universality in the B-sector: a global analyses of various new physics models* : Jacky Kumar
- *Explaining the $R_K$ and $R_{D^{(*)}}$ anomalies with leptoquarks*: Suchishmita Sahoo
- *Study of the rare decays $B_s^* \to l^+l^-$ in $Z'$ model* : Priya Maji
- *Lepton flavour violating B meson decays model* : Priti Nayek

## Lepton flavor universality violation in $B \to D^{(*)}\tau\bar{\nu}$ decays

- *Overview talk*: Jonas Rademacher
- *Optimal-observable analysis of possible new physics in $B \to D^{(*)}\tau\bar{\nu}$*: Sunando Patra
- *Extraction of $V_{cb}$ from $B \to D^{(*)}\tau\bar{\nu}$*: Sneha Jaisawal
- *$D^*$ polarization as a probe to discriminate new physics in $b \to c\tau\bar{\nu}$* : Suman Kumbhakar

## Probing new physics via FCNC decays induced by $b \to sl^+l^-$

- *Overview talk*: Jacky Kumar
- *Determining Form Factors and Wilson Coefficients using $B \to K^*\mu^+\mu^-$ data*: Bharti Kindra
- *Angular observables in $\Lambda_b \to \Lambda(\to p\pi)\ell^+\ell^-$ decay*: Shibasis Roy

## CP violation in B and D decays and mixing

- *Overview talk*: Anjan Giri
- *CP violation in charm sector at Belle*: Nibedita Dash
- *Decoherence effects in B decays and mixing*: Ashutosh Alok

## New physics in lepton number violating tau and muon decays

- *Overview talk*: Gagan Mohanthy

## Role of K decays in probing new physics

- *Overview talk*: Girish Kumar

## Hadron spectroscopy

- *Overview talk*: Zalak Shah
- *Analysis Techniques for Exotic Charged Charmonium-like Z states in Collider Experiments*: Nairit Sur

## Flavor physics and neutrinos (With WG-III)

- *Flavour anomalies and neutrino physics*: S. Uma Sankar
- *Model acpects* : Sabyasachi Chakraborty
- *LNV Meson decays* : Sanjoy Mandal

# Possible projects

*Probing new physics through $B_s \to V l^+ l^-$ decays.*

*Probing new physics through $CP$ conserving and $CP$ violating $b \to d l^+ l^-$ decays: Model independent and dependent approach*

*Light $Z'$ models and rare $K$ decays*

*$D \to \mu^+ \mu^-$ decay in various new physics models*

*$K_L \to \pi^0 \nu \bar{\nu}$ in various new physics models*

*Testing leptoquark models through EMC (European muon collaboration), SMS (Spin muon collaboration), NMC (New muon collaboration) results*

*Setting up Bell's inequality violation in correlated neutral meson systems*

*Effect of decoherence in D meson decays and mixing*


Thank You