

$$\bar{B} \rightarrow D\tau\nu \text{ and } \bar{B} \rightarrow D^*\tau\nu$$

Alejandro Celis, IFIC, Univ. Valencia - CSIC.

Advisor: Antonio Pich.

- ▶ Evidence for an excess of $B \rightarrow D^{(*)}\tau\nu$ decays, the BaBar Collaboration [arXiv:1205.5442](https://arxiv.org/abs/1205.5442)
- ▶ tree level process in the SM, $b \rightarrow cW$
- ▶ very interesting from the flavor point of view : b, c, τ
- ▶ very rich kinematics: differential decay distributions, angular asymmetries, polarization fractions. . .

$$R(D^{(*)}) = \text{Br}(B \rightarrow D^{(*)}\tau\nu)/\text{Br}(B \rightarrow D^{(*)}l\nu)$$

$$R(D)_{SM} = 0.297(17) \text{ and } R(D^*)_{SM} = 0.252(3)$$

$$R(D) = 0.440(71) \text{ and } R(D^*) = 0.332(29)$$

errors dominated by statistical uncertainties, theo. very small !

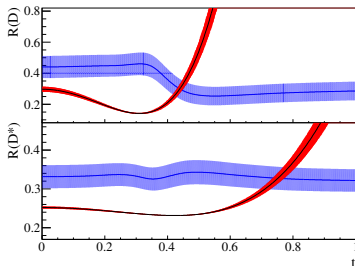
Combined 3.4 σ deviation from the SM

Violation of lepton flavor universality at $\approx 30\%$

Universality of the leptonic W^\pm tested at the 0.2% level

Type II Two-Higgs Doublet Model

$$\tan \beta / M_{H^+} = 0.44(22) \text{ GeV}^{-1}, \quad \tan \beta / M_{H^+} = 0.75(4) \text{ GeV}^{-1}$$



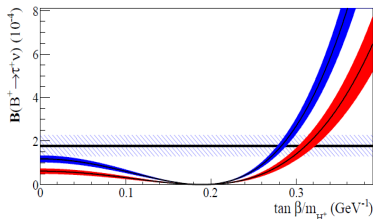
taken from [arXiv:1205.5442](https://arxiv.org/abs/1205.5442) .

$R(D)$ and $R(D^*)$ exclude the Type II charged Higgs boson at 99.8% C.L for any value of $\tan \beta / M_{H^+}$.

Type II Two-Higgs Doublet Model

$\text{Br}(B \rightarrow \tau\nu)(\times 10^4)$ by the summer of 2012!

1.65 ± 0.34 WA vs 0.96 ± 0.26 Belle SM : 0.73 ± 0.12



taken from G. De Nardo talk at ICHEP12.

- ▶ wait for new Belle results!
- ▶ Refine our theoretical predictions and reconsider our assumptions (Lattice QCD, Heavy Quark Effective Theory, . . .)
- ▶ What kind of new physics can accommodate this result?