Bayesian fit analysis to full distribution data of B→D$^{(*)}\ell\nu$: |Vcb|determination and new physics constraints

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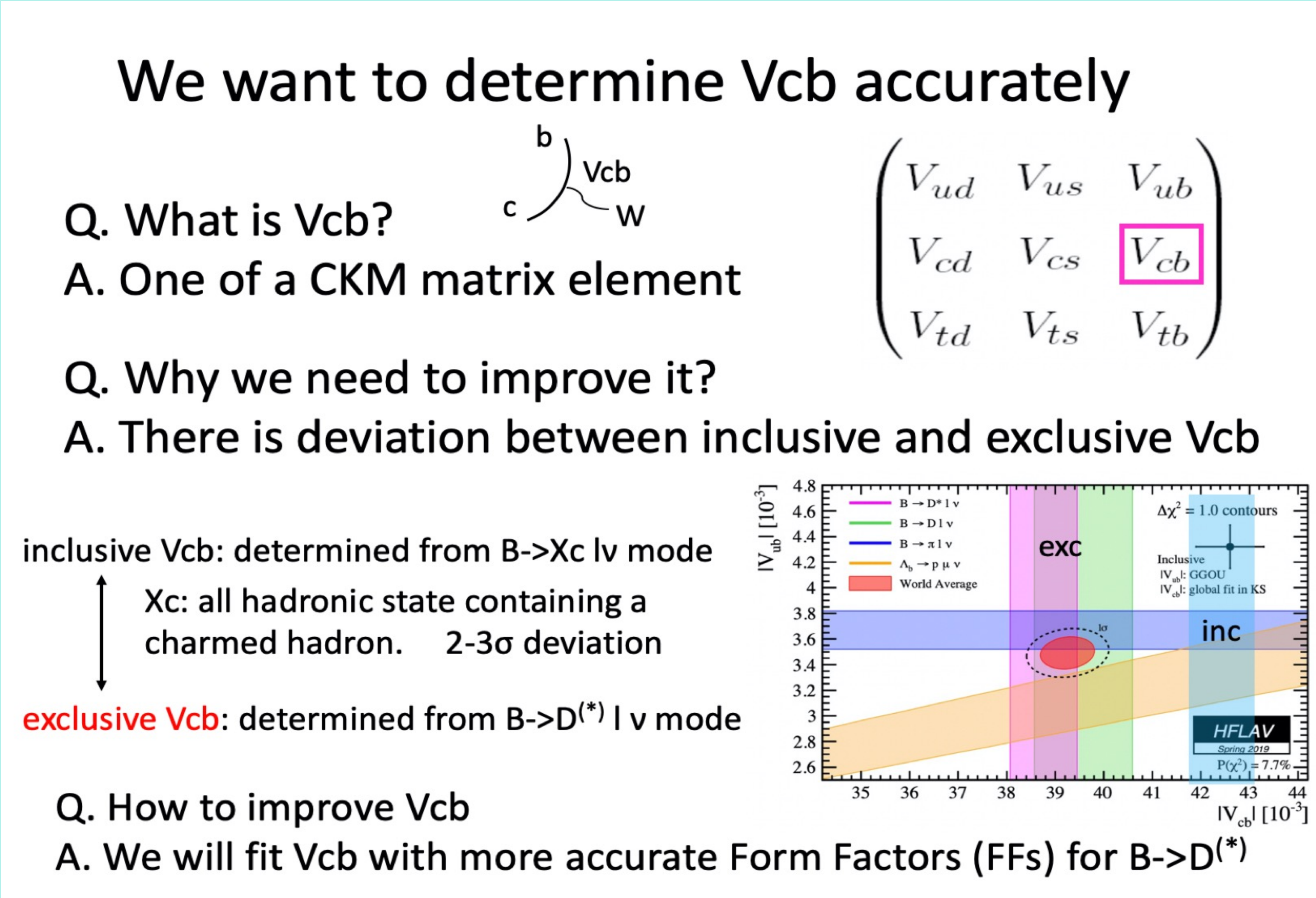
Contents

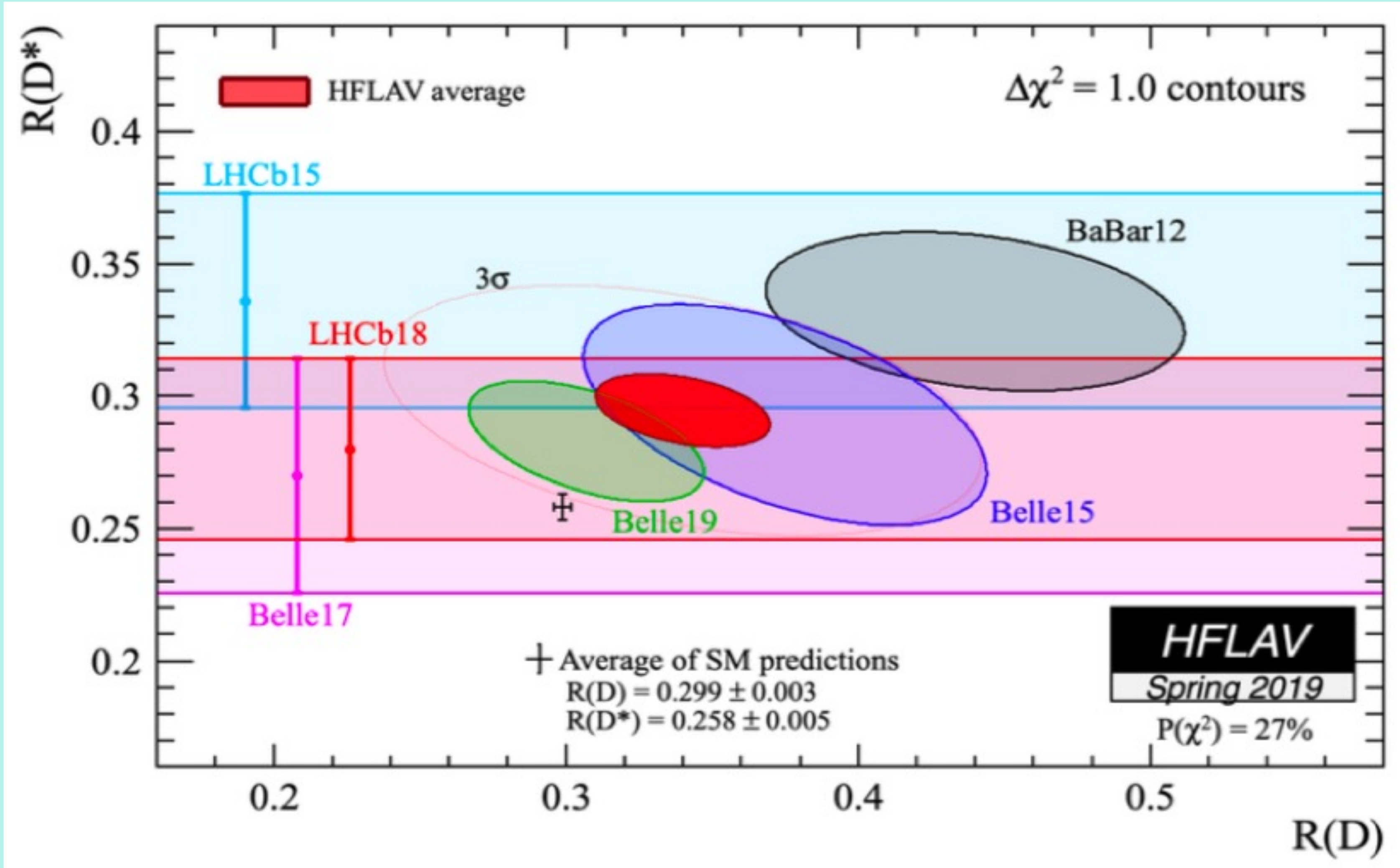
We performed the Bayesian fit to determine the B→D$^{(*)}$ hadronic transition form factors. using the full distribution data from Belle and theoretical constraints. The fitted Vcb is consistent with the HFLAG average and the Vcb puzzle can not be resolved. Based on the fitted form factors, we discuss the B→D$^{(*)}\tau\nu$ process where the 4σ level discrepancy between the SM prediction and the experimental average is known.
Implications to the collider physic of the NP interpretation of R($D^{(*)}$) anomaly is discussed.

Motivation

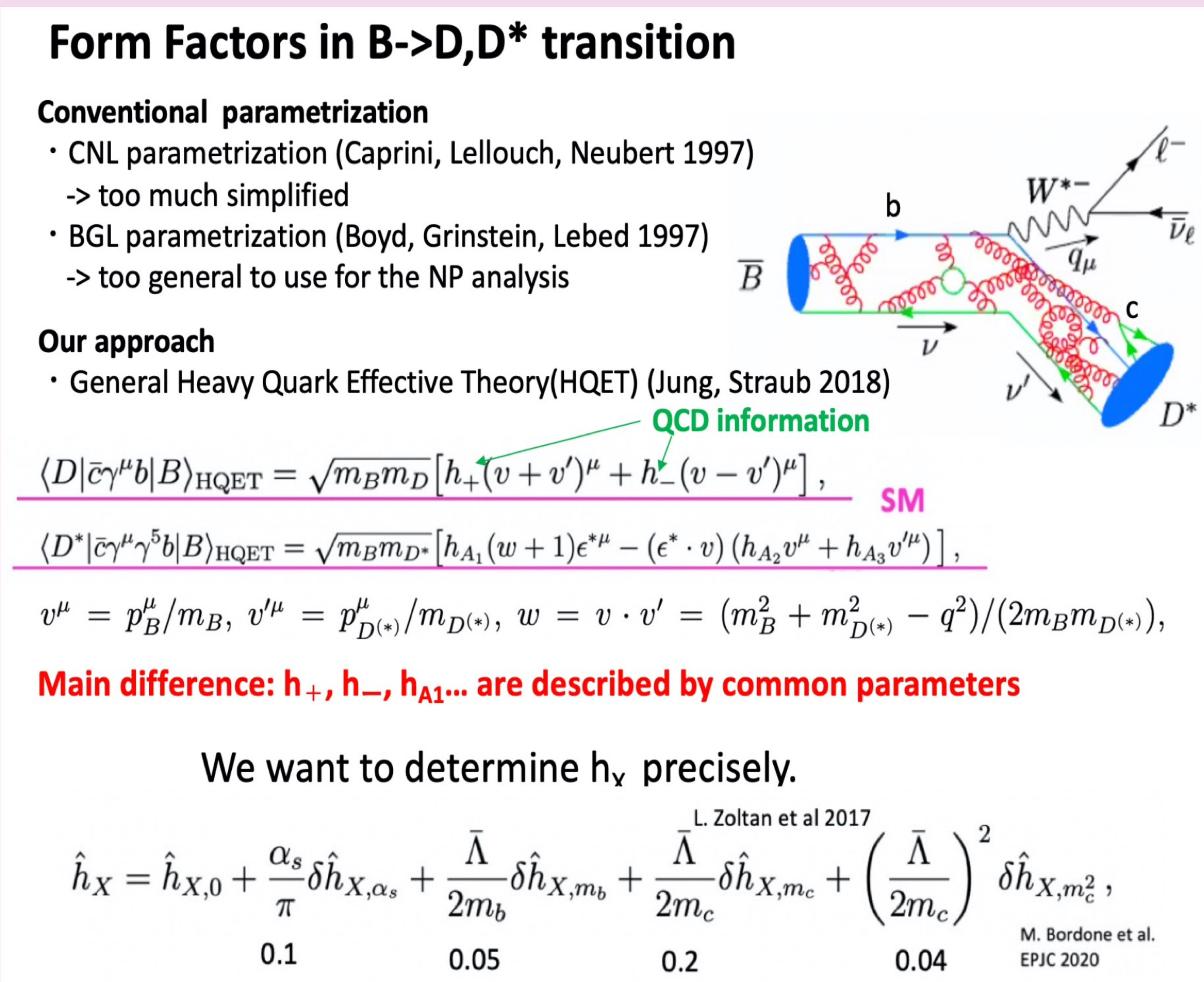


Suggestive anomalies in R($D^{(*)}$)

$$R(D^{(*)}) = Br(B \to D^{(*)}\tau\nu)/Br(B \to D^{(*)}l\nu) \quad l=\mu, e$$

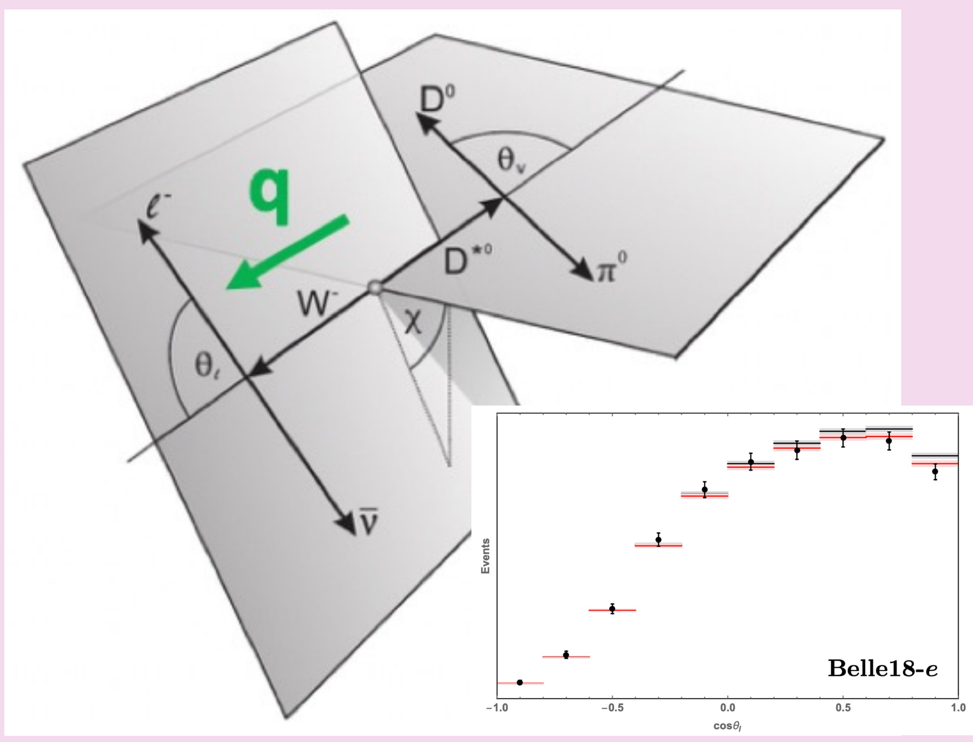


Vcb determination

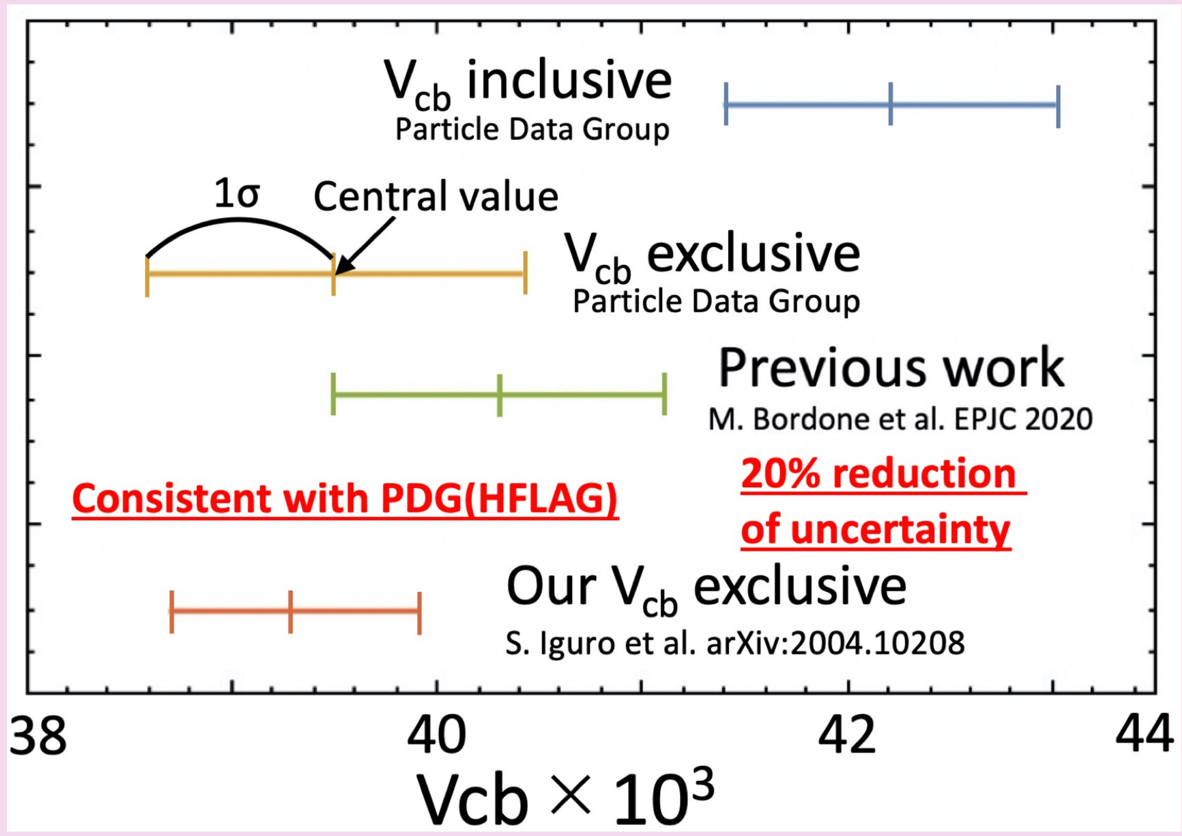


What's new

We also included the angular distribution data and performed the Bayesian fit to fix the form factors.

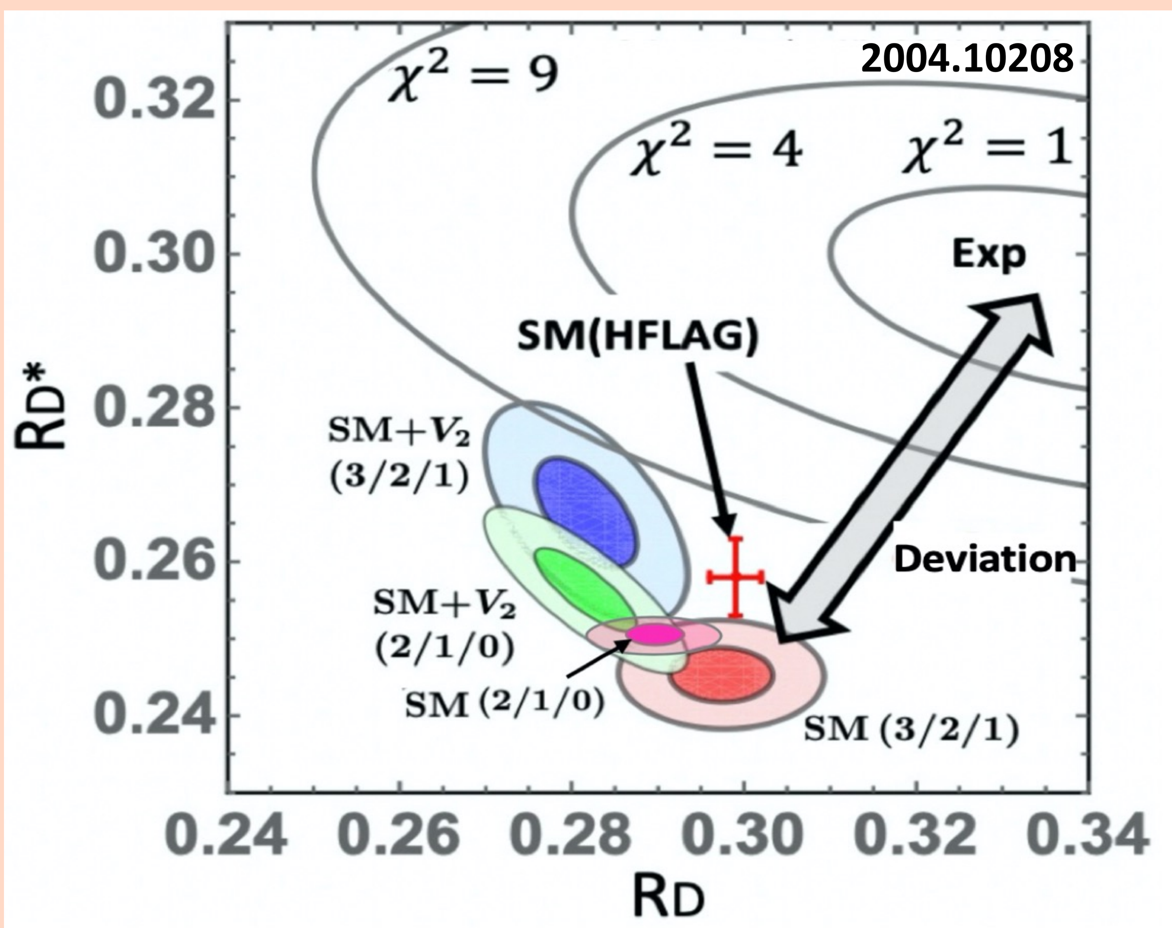


Result



B→D$^{(*)}\tau\nu$ observables

4.2σ deviation is found



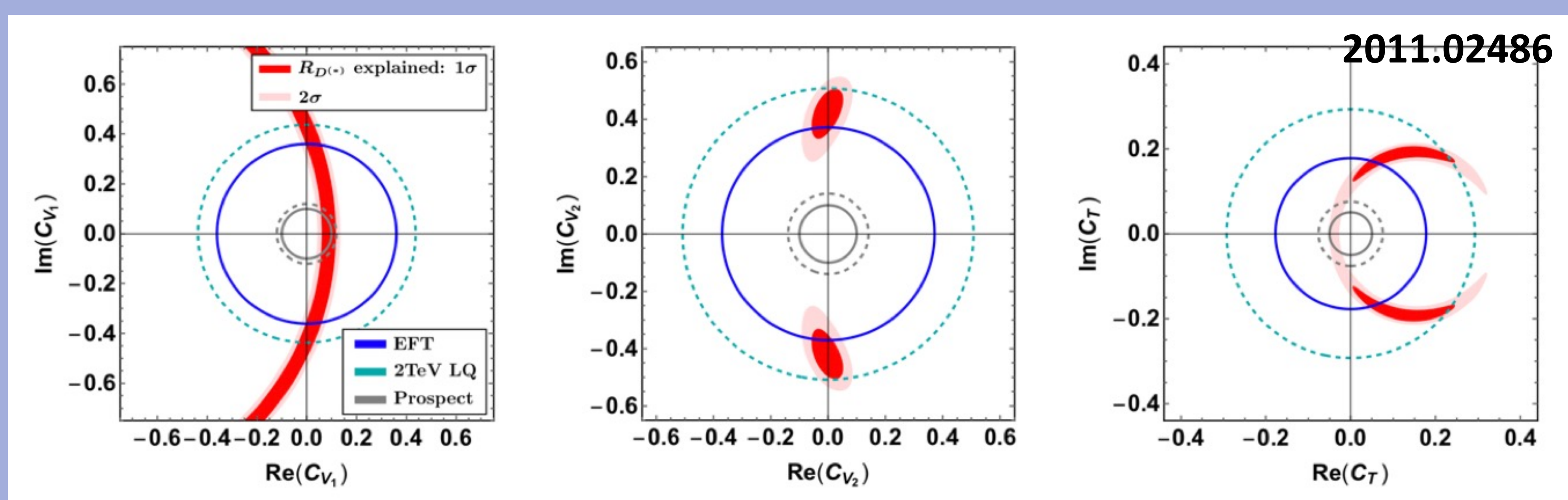
Implication for LHC

$$H_{eff} = \frac{4G_F}{\sqrt{2}} V_{cb} \left[(1 + C_{V1})O_{V1} + C_{V2}O_{V2} + C_T O_T\right]$$

$$O_{V1} = (\bar{c}\gamma^\mu P_L b)(\bar{l}\gamma^\mu P_L \nu_\tau),\ O_{V2} = (\bar{c}\gamma^\mu P_R b)(\bar{l}\gamma^\mu P_L \nu_\tau),$$
$$O_T = (\bar{c}\sigma^{\mu\nu} P_L b)(\bar{l}\sigma_{\mu\nu} P_L \nu_\tau)$$

High pT mono τ signal

pp-> bc -> τν process



Mediator mass dependence is significant!