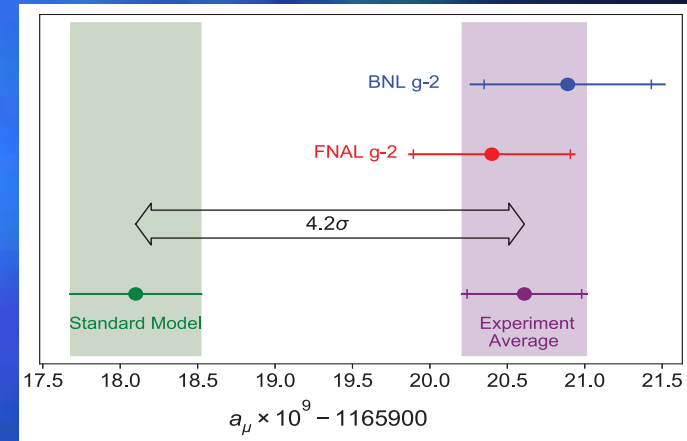
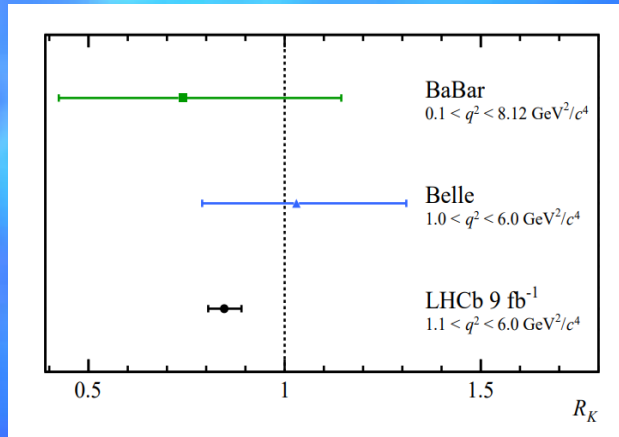
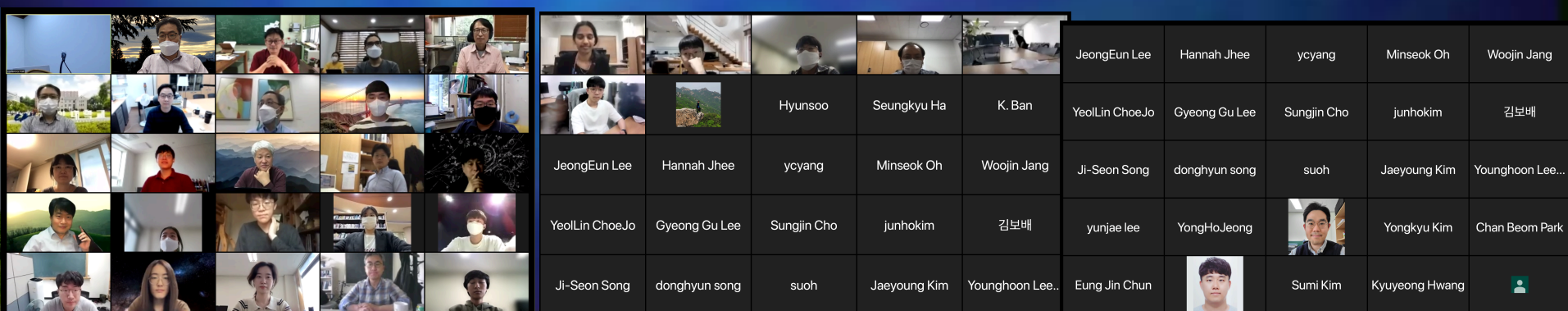


Muon Anomalies Workshop [MAW]

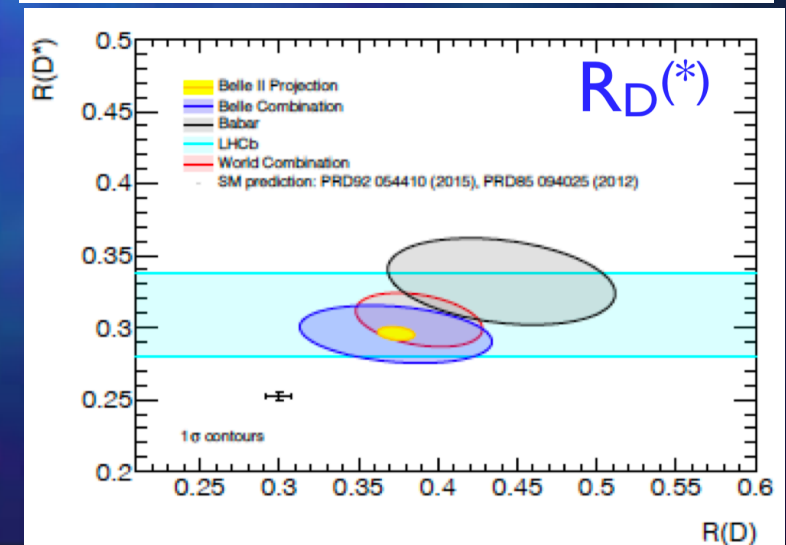
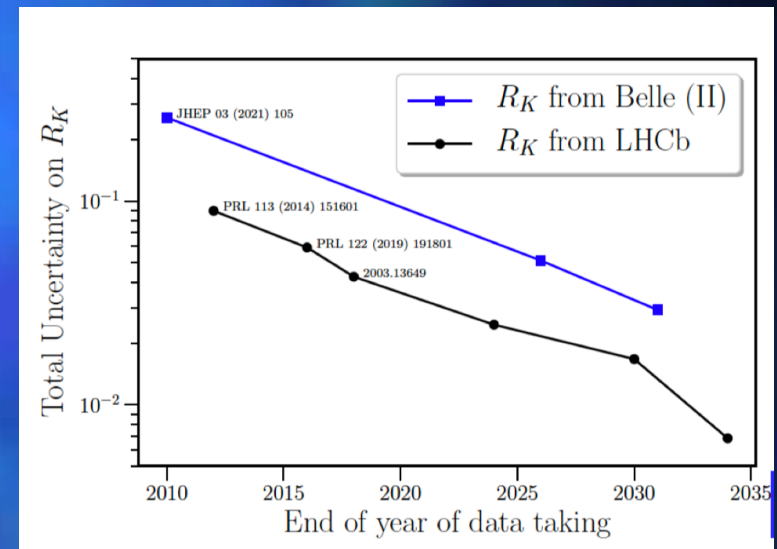
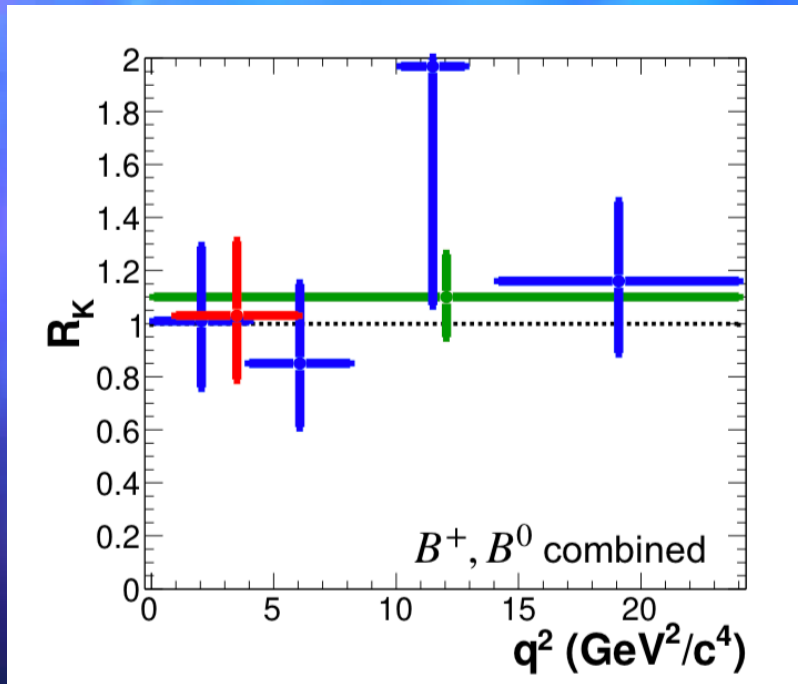


- 6 Experimental talks (1 Belle + 5 CMS)
- 6 theory talks
- Online (~65) + Offline (~16): 81 participants



Belle II

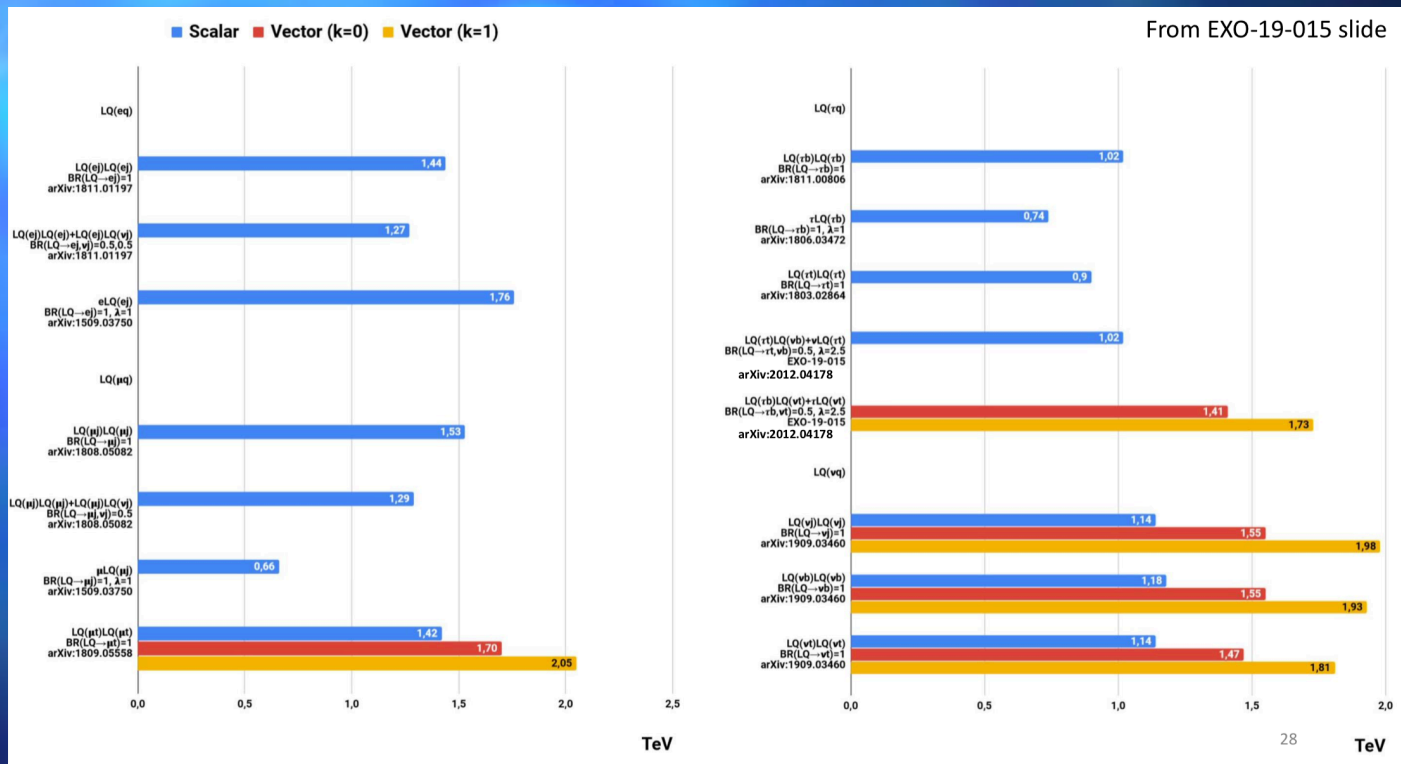
- Lepton flavor violation in $B \rightarrow K\ell\ell$
- Q^2 dependence



$$R_K = \begin{cases} 1.01^{+0.28}_{-0.25} \pm 0.02 & q^2 \in (0.1, 4.0) \text{ GeV}^2/c^4, \\ 0.85^{+0.30}_{-0.24} \pm 0.01 & q^2 \in (4.00, 8.12) \text{ GeV}^2/c^4, \\ 1.03^{+0.28}_{-0.24} \pm 0.01 & q^2 \in (1.0, 6.0) \text{ GeV}^2/c^4, \\ 1.97^{+1.03}_{-0.89} \pm 0.02 & q^2 \in (10.2, 12.8) \text{ GeV}^2/c^4, \\ 1.16^{+0.30}_{-0.27} \pm 0.01 & q^2 > 14.18 \text{ GeV}^2/c^4. \end{cases}$$

Leptoquark Searches

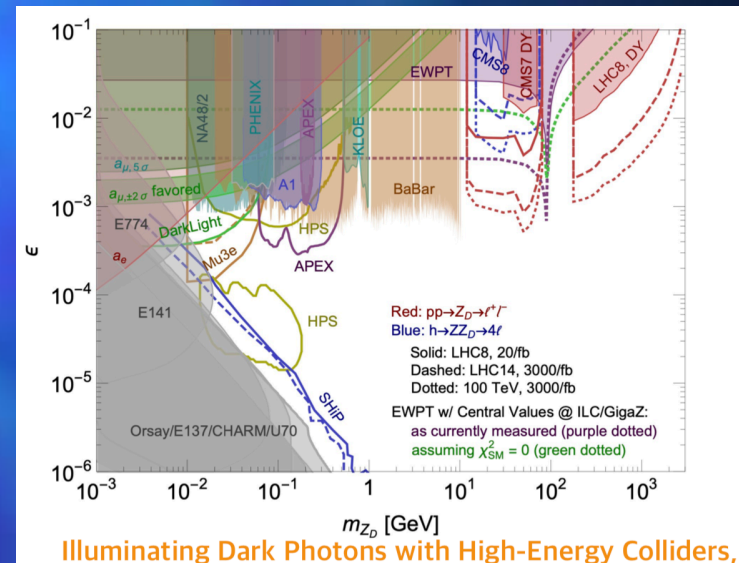
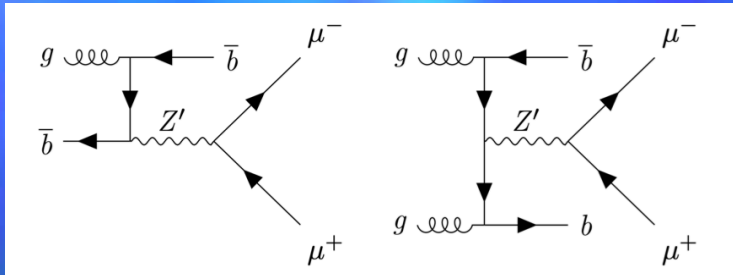
- 1st, 2nd, 3rd generations LQs are excluded up to ~1-2 TeV



- **Leptoquarks from top quark decays: $t \rightarrow c\tau$**

Z' , dark photon, anomalous dimuon

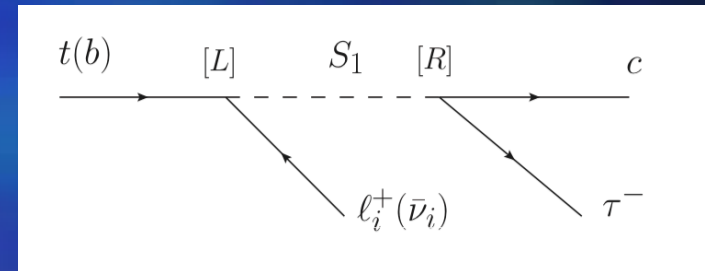
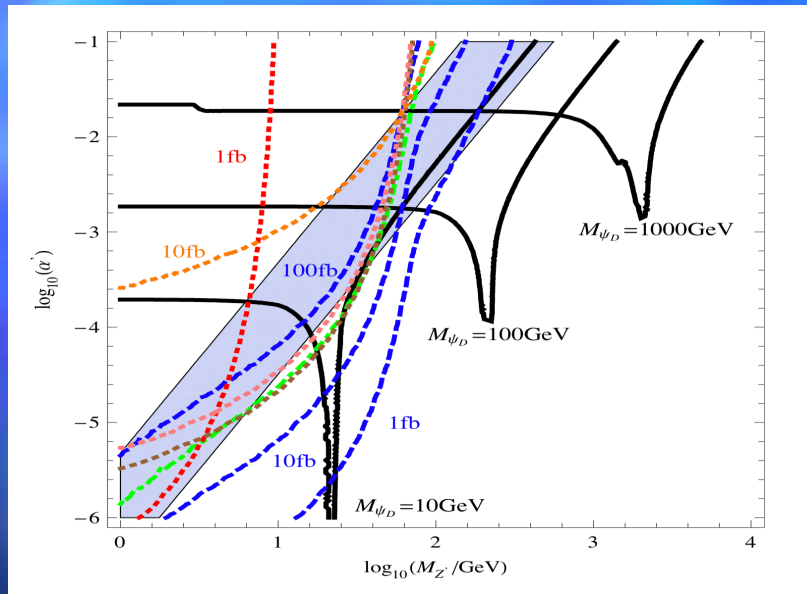
- $Z' \rightarrow ee, \mu\mu$
- $Z' + b \text{ (or } bb) \rightarrow ee, \mu\mu$



- Anomalous dimuon production inside b-jets
 - OS vs SS data

Models

- B. Ko: U(1) L_μ-L_τ models, U(1)B-L with 3 RH Ns
 - R(D*) vs Top FCNC

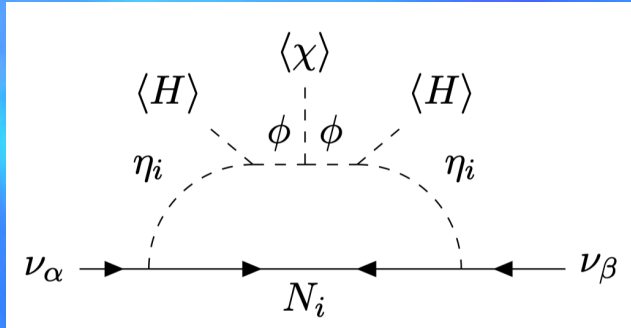


$$S_1 : Br(t \rightarrow c \tau^- \ell_l^+) \approx \frac{1}{\Gamma_{t,SM}} \left(\frac{m_t^5}{6144 \pi^3} \right) | \frac{g_{1L}^{3l} g_{1R}^{23*}}{M_{S_1}^2} |^2 = 10^{-6} \times \begin{cases} 1.4 \sim 1.8 & l = 1, 2 \\ 0.16 \sim 0.41 & l = 3 \end{cases} \quad (3.1)$$

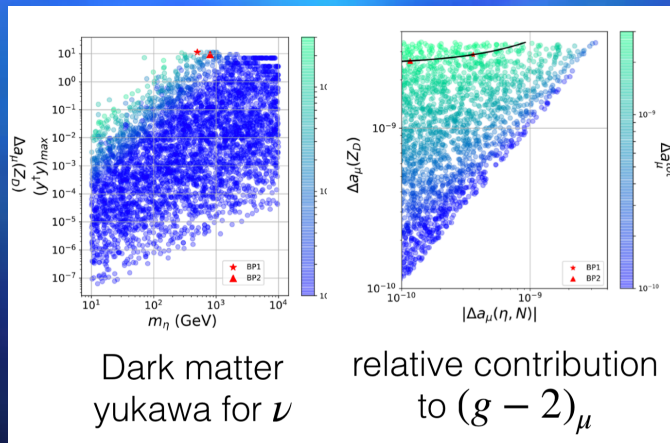
$$U_1 : Br(t \rightarrow c \nu_\tau \bar{\nu}_l) \approx \frac{1}{\Gamma_{t,SM}} \left(\frac{m_t^5}{1536 \pi^3} \right) | \frac{h_{1L}^{33} h_{1L}^{2l*}}{M_{U_1}^2} |^2 = 10^{-6} \times \begin{cases} 0.58 \sim 1.5 & l = 1, 2 \\ 17 \sim 19 & l = 3 \end{cases} \quad (3.2)$$

ν mass with dark U(1) symmetry

➤ Scotogenic model



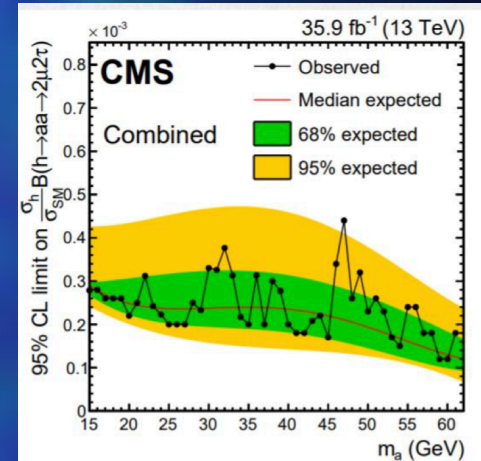
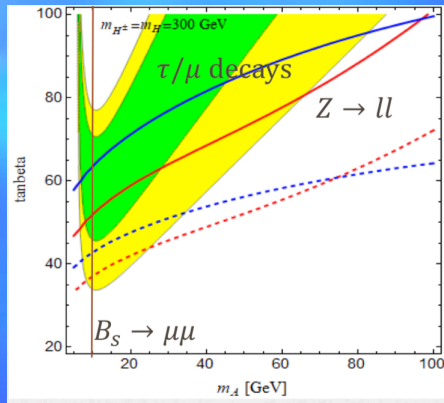
➤ Dark photon: ~ 100 MeV, DM: 1 GeV \sim 1 TeV



➤ Possibility to check at the LHC?

Leptophilic boson in 2HDM of type-X

➤ Leptophilic favored region



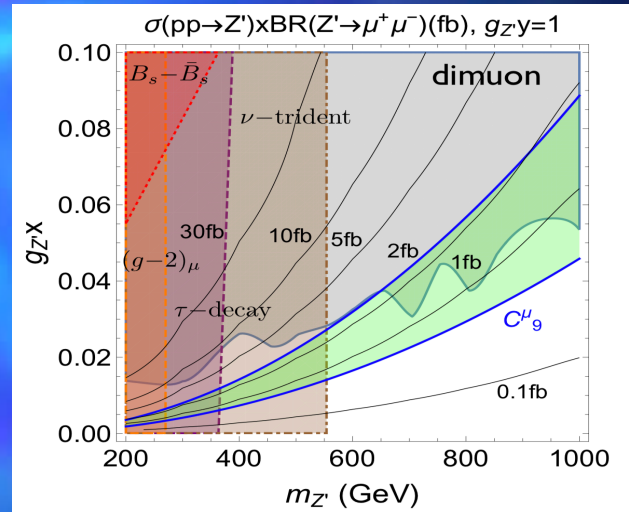
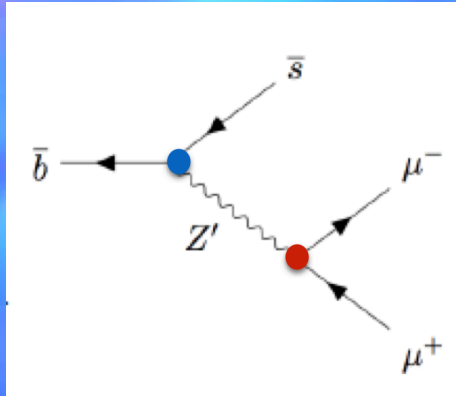
➤ LHC: pp (DY) → H[±] + A (or AA) → 4τ, 3τ (2τ2μ)

➤ Further possibility at the LHC

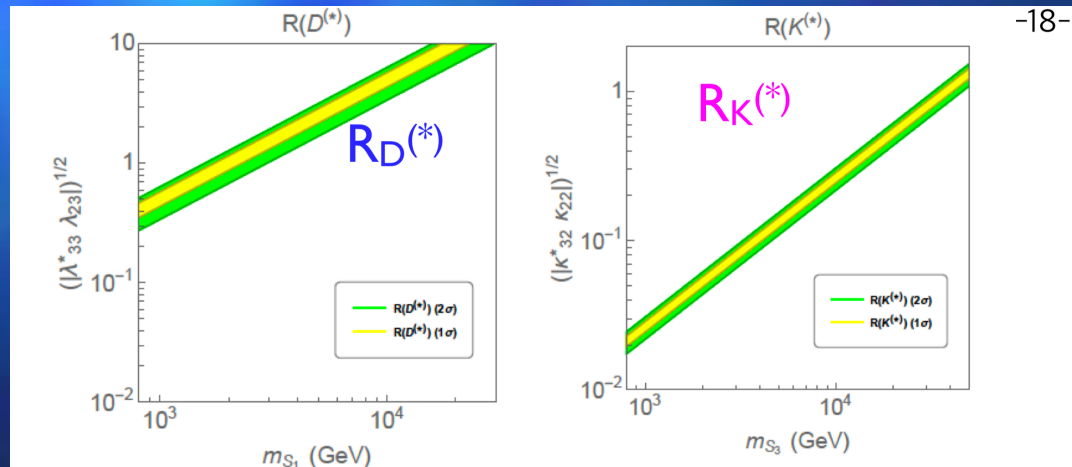
- pp → ττ φ(ττ):

$$\phi(\tau\tau) = \mu^\pm + trk^\mp(\mu^\mp / e^\mp / h^\mp)$$

Anomaly free U(1)



Minimal flavor for LQs



Extra doublet leptoquarks \rightarrow neutrino mass generation

Models

- Anomaly free U(1) model, Z'
- Leptoquarks
- Type-X 2HDM (leptophilic or not)
 - $H^+, A \rightarrow (2\tau 2\mu), 2\tau \phi(\tau\tau)$
- Dark photon U(1) symmetry \rightarrow neutrino mass