

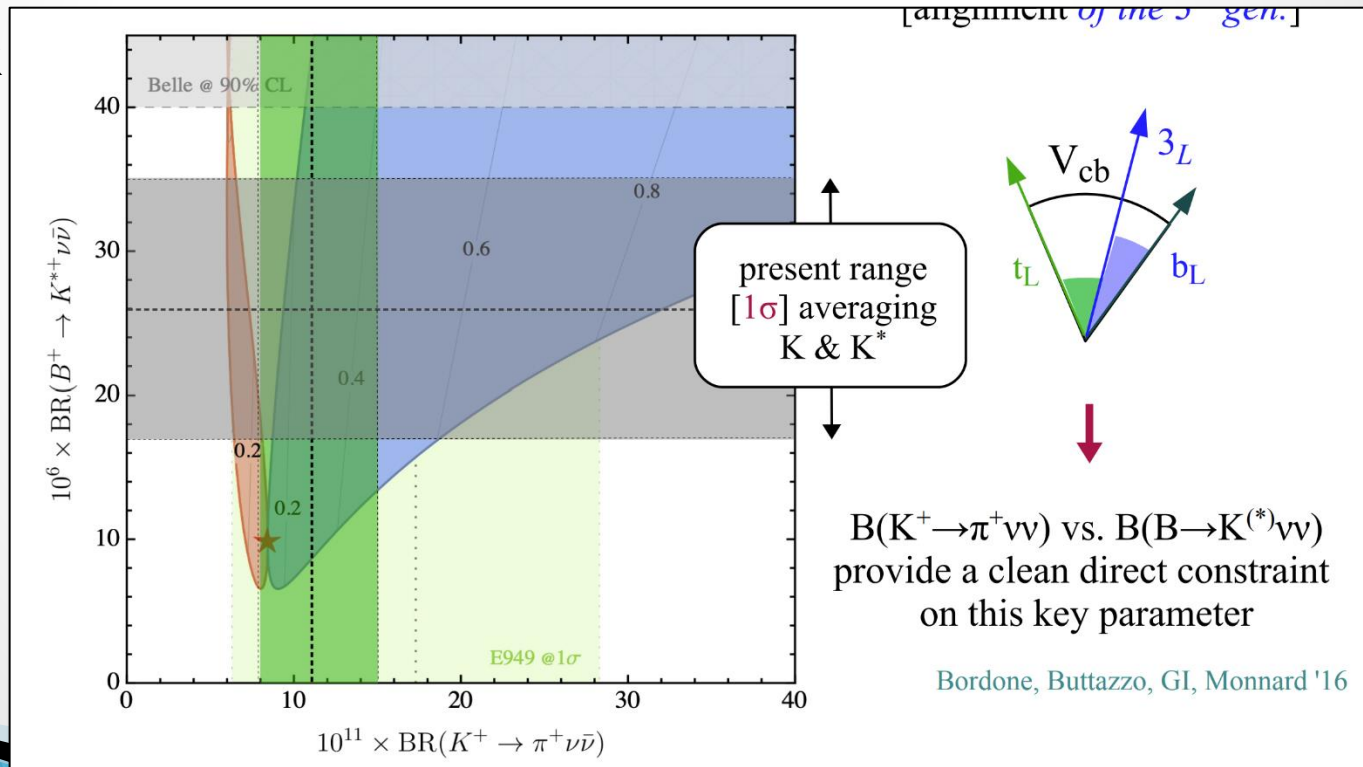
Discussion Session: B versus K

Giancarlo D'Ambrosio, Frank Deppisch

B versus K

- ▶ Are B and K really complementary in the search for new physics? How?
- ▶ What are the K vs B relations, depending on BSM models? Can it be looked at from a model independent perspective?

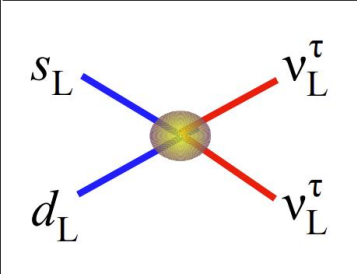
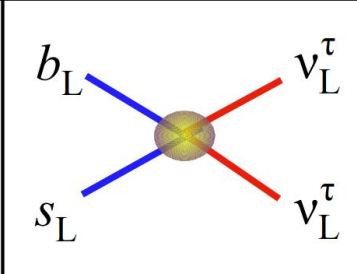
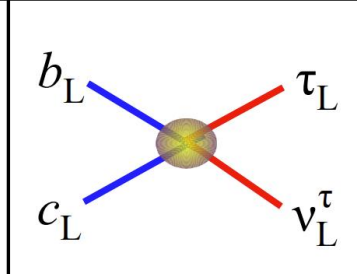
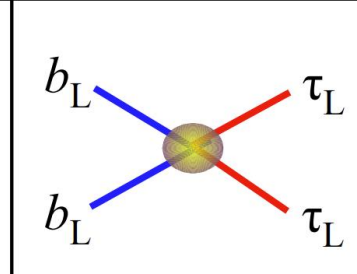
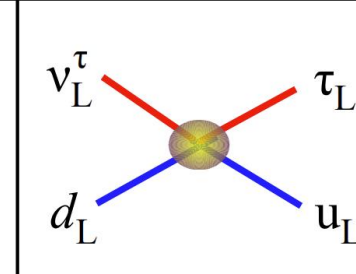
G. Isidori Talk



B versus K

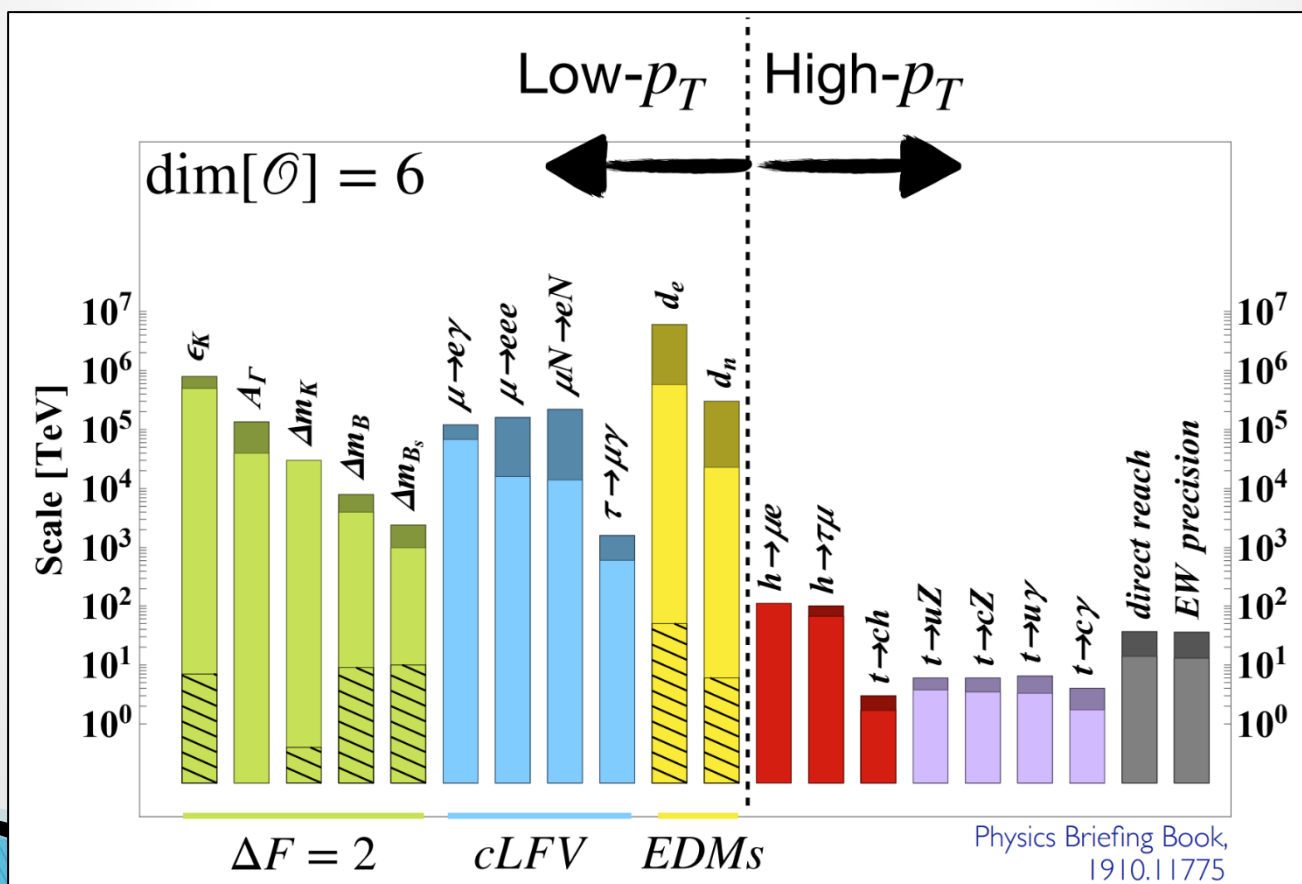
- What can be gained from a global analysis that combines both B and K (also lepton physics and EDM searches)?

G. Isidori Talk

$C \times V_{ts} V_{td} $	$C \times V_{ts} $	$C \times V_{cb} $	C	$C \times V_{ub} V_{td} $
				
$B(K^+ \rightarrow \pi^+ \nu \bar{\nu})$	$B(B^+ \rightarrow K^+ \nu \bar{\nu})$	$R[D^{(*)}]$	$\sigma(pp \rightarrow \tau \tau)$	$\sigma(\nu^\tau N \rightarrow N' \tau)$
Now [NA62]: $\Lambda > 1.7 \text{ TeV}$ $\delta B = 5\%$ [HIKE]: $\Lambda > 4.7 \text{ TeV}$	Now [Belle-II]: $\Lambda > 1.3 \text{ TeV}$ 50 ab^{-1} [Belle-II]: $\Lambda > 3.6 \text{ TeV}$	Now [HFLAV]: $\Lambda > 0.6 \text{ TeV}$ 50 ab^{-1} [Belle-II]: $\Lambda > 1.2 \text{ TeV}$	Now [ATLAS]: $\Lambda > 1.2 \text{ TeV}$ 3 ab^{-1} [HL-LHC]: $\Lambda > 1.7 \text{ TeV}$	Now: — $\delta \sigma = 5\%$ [future ?]: —

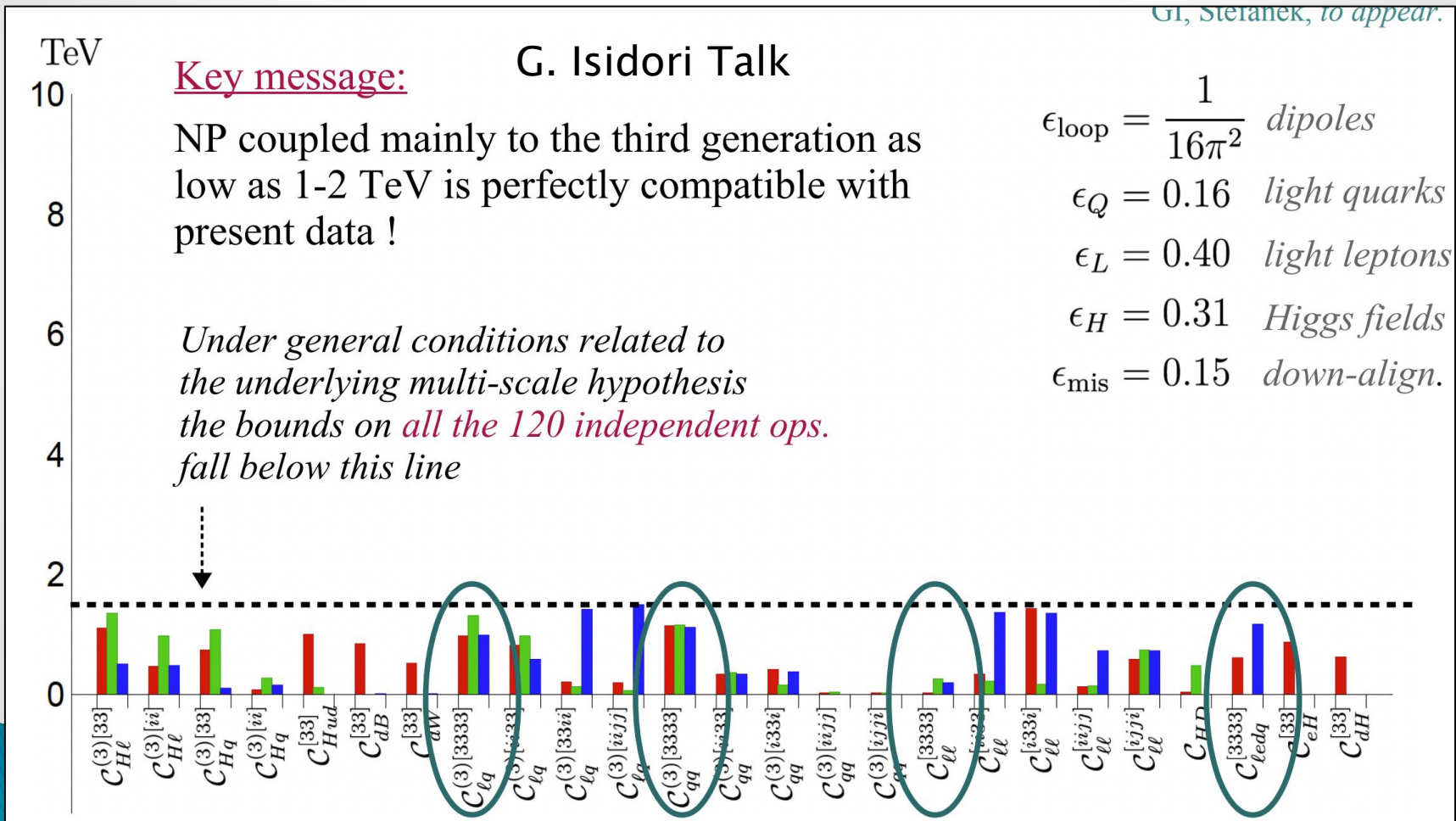
B versus K

- Which mass scales can be accessed by different FCNC processes? And is the mass scale really the relevant measure to quantify the impact of BSM reach?



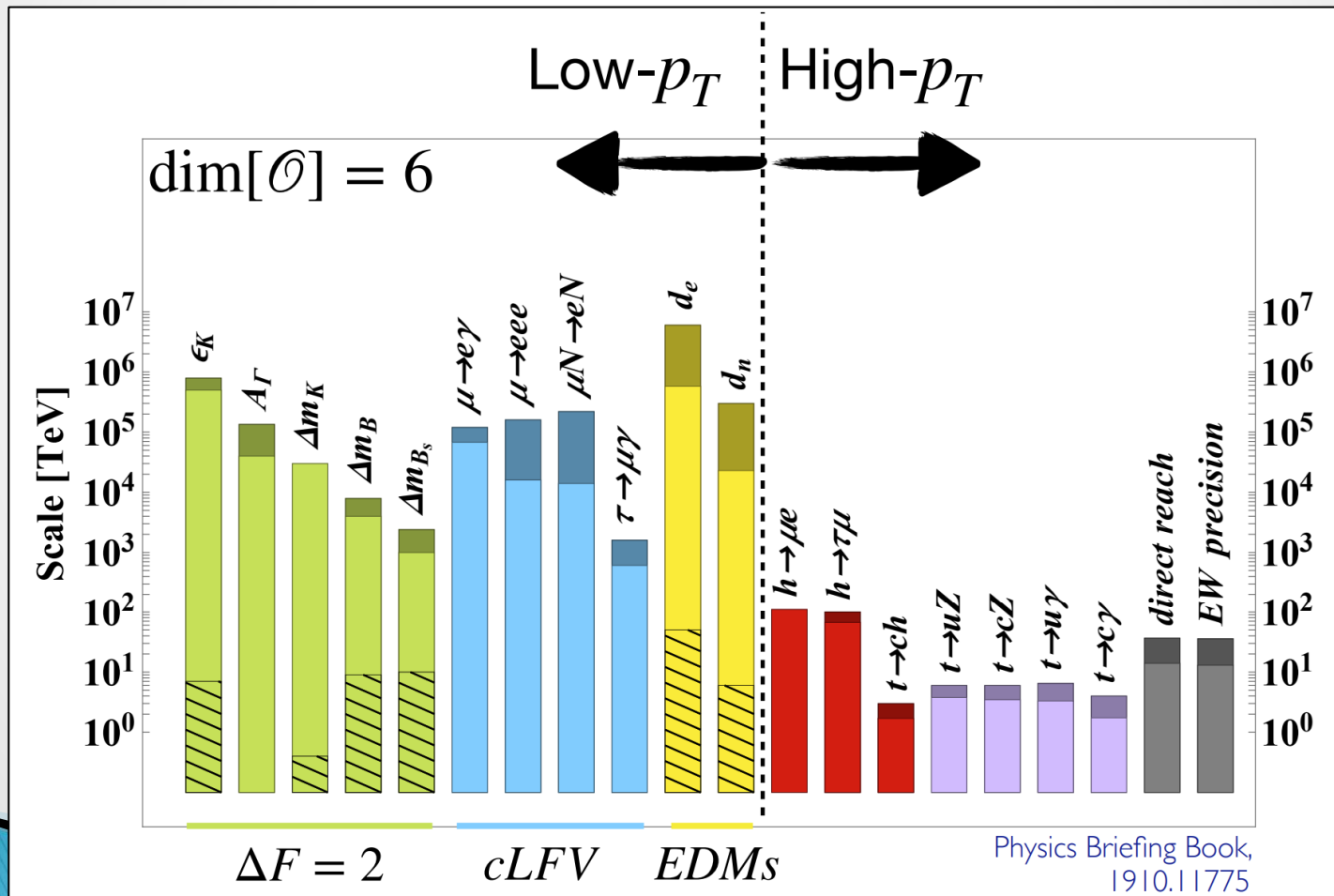
B versus K

- Can BSM be addressed in a model-independent way? Or do we need to explore model by model?



B versus K

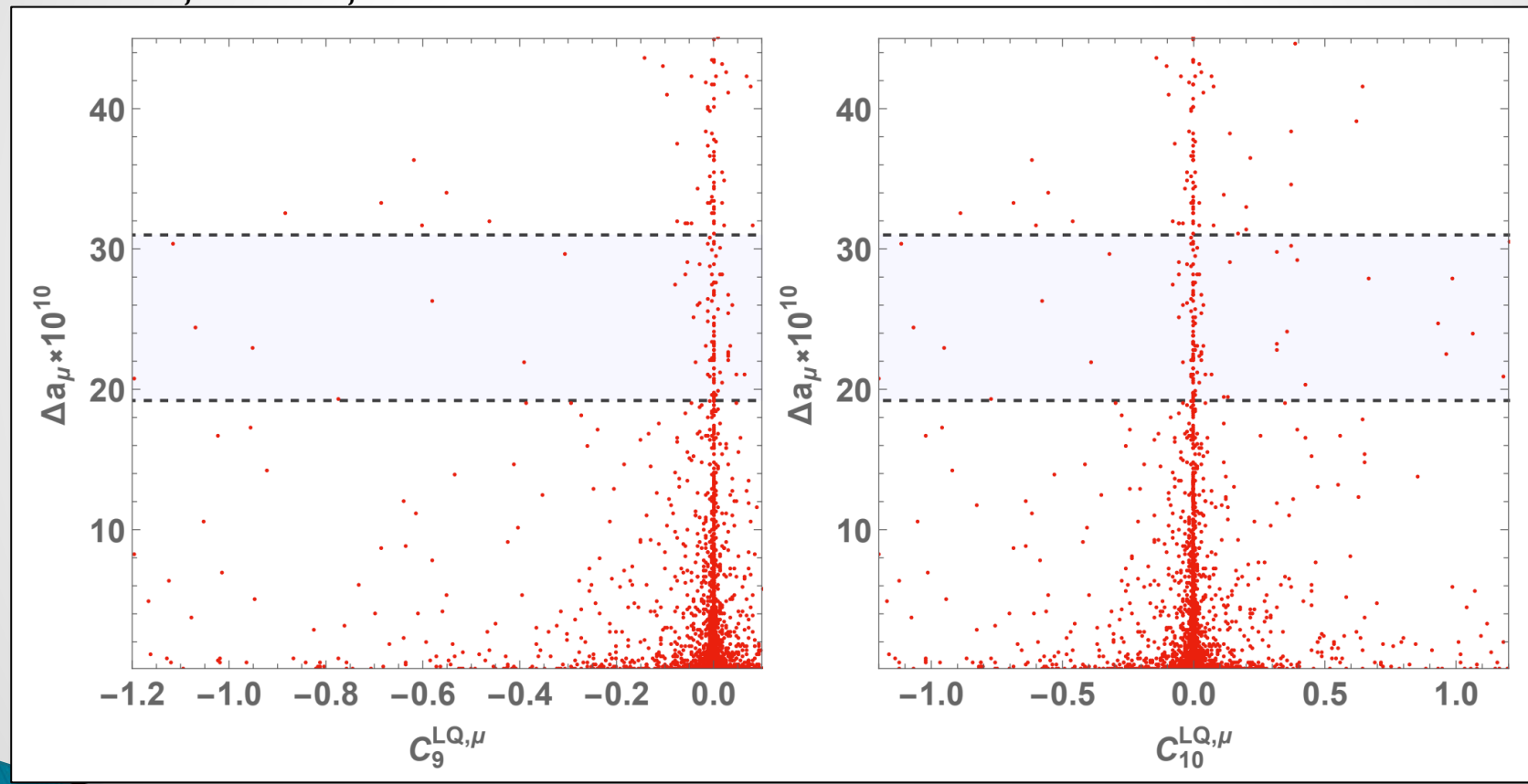
- Which are the strongest constraints on BSM from measurements, from the K sector and the B sector?



B versus K

- ▶ Can the same BSM affect $g-2$ and the K and B sectors?

Tomura, Okada, 2021



- ▶ What can be learnt from limits on the LFV, LNV kaon and pion decay rates in terms of BSM? Do they relate to B channels?

E. Goudzovski Talk

Upper limits at 90% CL from NA62 Run 1 data:

PLB797 (2019) 134794: $\text{BR}(K^+ \rightarrow \pi^- \mu^+ \mu^+) < 4.2 \times 10^{-11}$ (a partial 25% sample)

PRL127 (2021) 131802: $\text{BR}(K^+ \rightarrow \pi^- \mu^+ e^+) < 4.2 \times 10^{-11}$

$\text{BR}(K^+ \rightarrow \pi^+ \mu^- e^+) < 6.6 \times 10^{-11}$

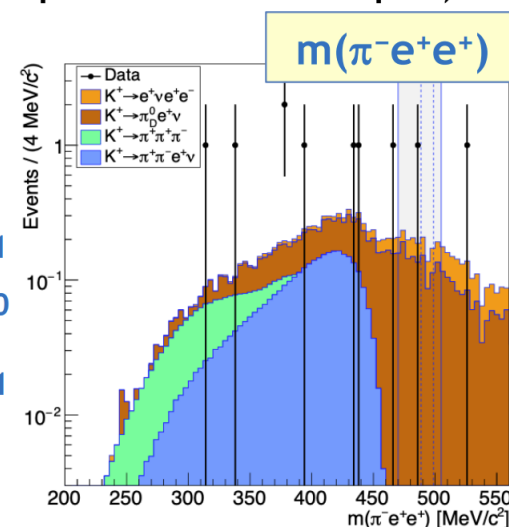
$\text{BR}(\pi^0 \rightarrow \mu^- e^+) < 3.2 \times 10^{-10}$

PLB830 (2022) 137172: $\text{BR}(K^+ \rightarrow \pi^- e^+ e^+) < 5.3 \times 10^{-11}$

$\text{BR}(K^+ \rightarrow \pi^- \pi^0 e^+ e^+) < 8.5 \times 10^{-10}$

PLB838 (2023) 137679: $\text{BR}(K^+ \rightarrow \mu^- \nu e^+ e^+) < 8.1 \times 10^{-11}$

... and the first search for $K^+ \rightarrow \pi \pi^0 \mu e$ is in progress ...



Pre-NA62 upper limits, to be improved with the full NA62 dataset

❖ $\text{BR}(K^+ \rightarrow \pi^+ \mu^+ e^-) < 1.3 \times 10^{-11}$ [BNL E865+E777, PRD72 (2005) 012005]

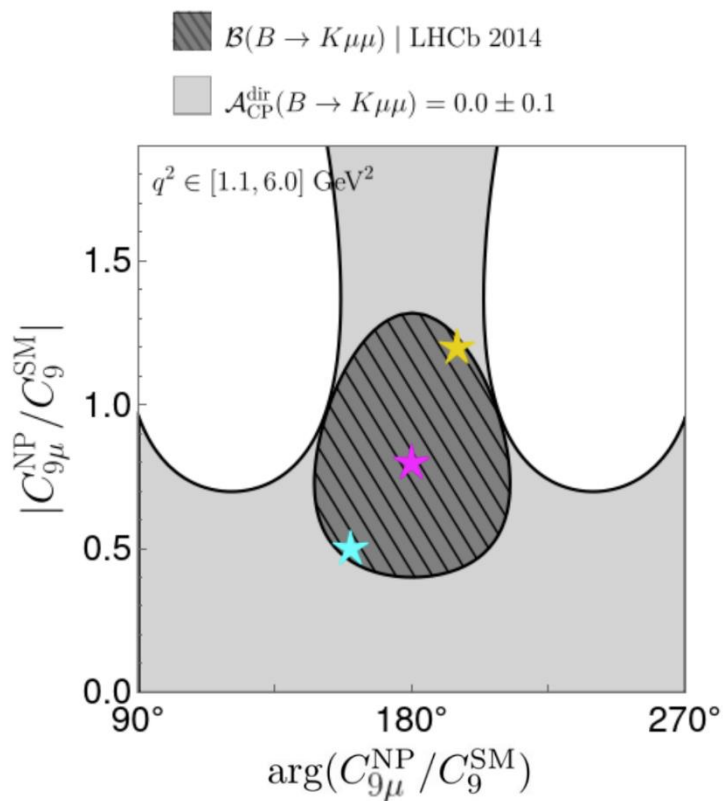
❖ $\text{BR}(\pi^0 \rightarrow \mu^- e^+) < 3.8 \times 10^{-10}$ [BNL E865, PRL85 (2000) 2450]

B versus K

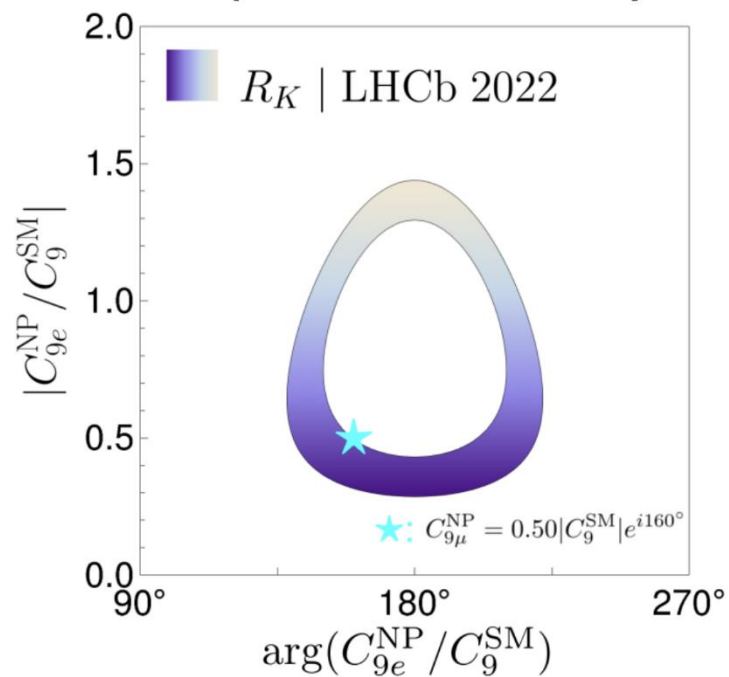
- ▶ What is the role of extra sources of CP violation?

Anders Rehult,
CORFU23

$C_9 \in \mathbb{C} \rightarrow$ CP violation



A surprising amount of space
for μ/e nonuniversality!



B versus K

- ▶ What is the role of massive neutrinos in model building for flavour?