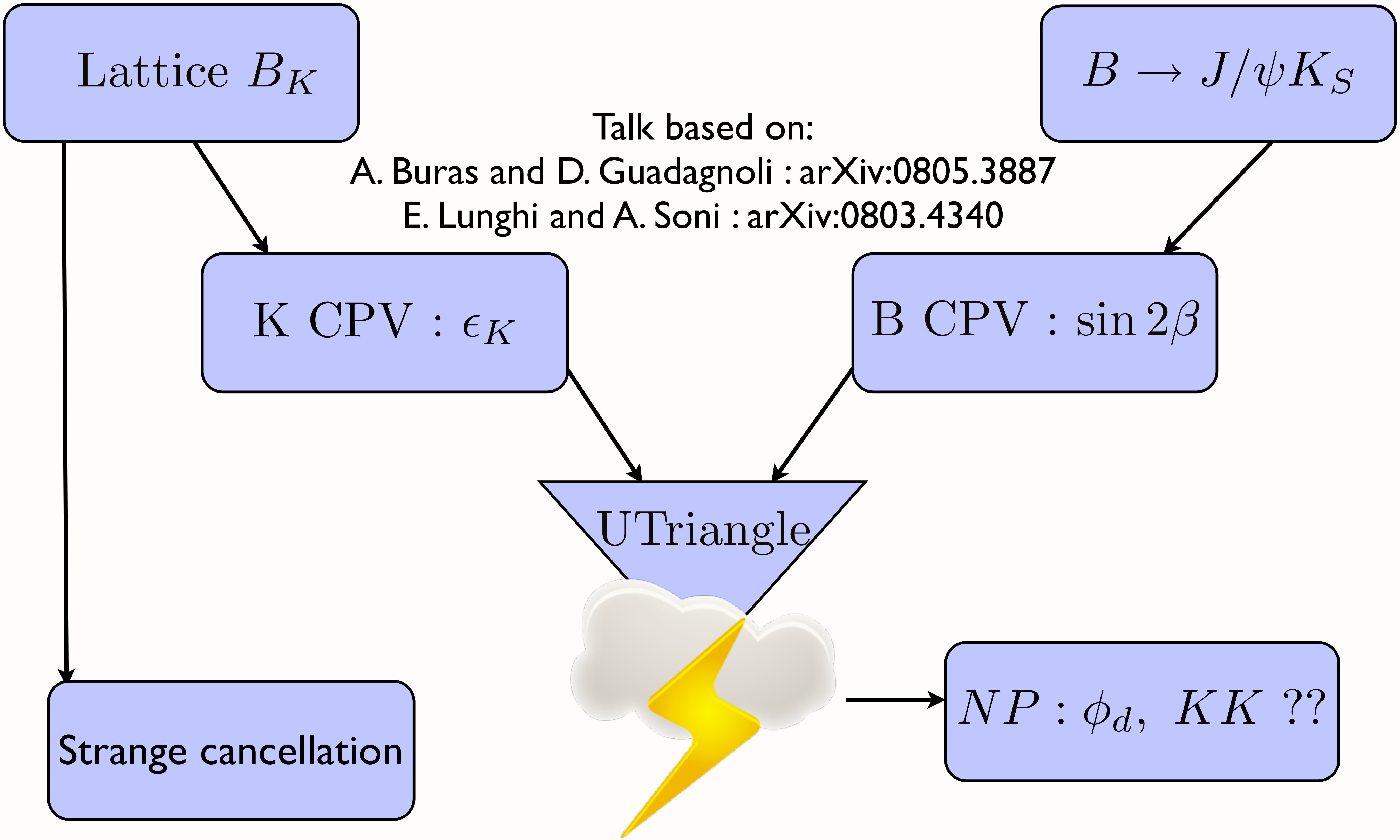
Tension between K and B physics as a hint of new physics ?

Mertens Philippe - BND School 2009 - Rathen - 19/09/09

Outline

Talk based on:
A. Buras and D. Guadagnoli : arXiv:0805.3887
E. Lunghi and A. Soni : arXiv:0803.4340



On the K meson Side

Let’s have a look on Kaon’s decays into two pions (CP+) :

$$\mathrm{Br}(K_S \to \pi^+\pi^-) = (30.69 \pm 0.05)\%$$
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$$|\epsilon_K| = (2.228 \pm 0.011) \times 10^{-3}$$

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to be compared with $\epsilon_K \sim \mathcal{O}(10^{-3})$

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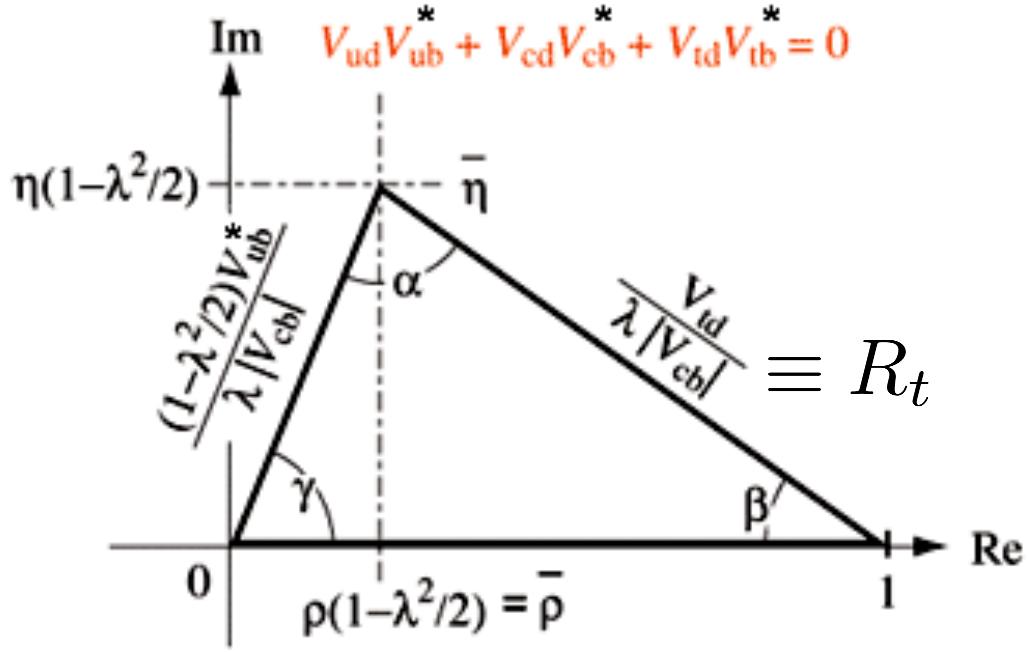

$\equiv R_t$

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Figure 1. The unitarity relation $V_{ud}V_{ub}^* + V_{cd}V_{cb}^* + V_{td}V_{tb}^* = 0$ drawn in the complex $[\bar{\rho}, \bar{\eta}]$ plane.

$$\eta(1-\rho) = 1/2 R_t^2 \sin 2\beta$$

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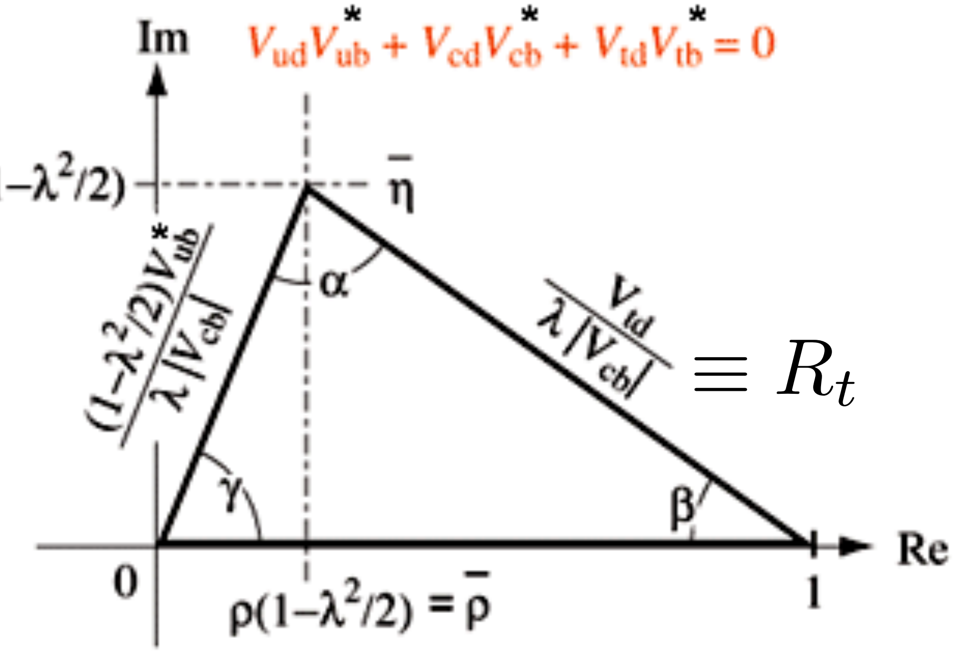

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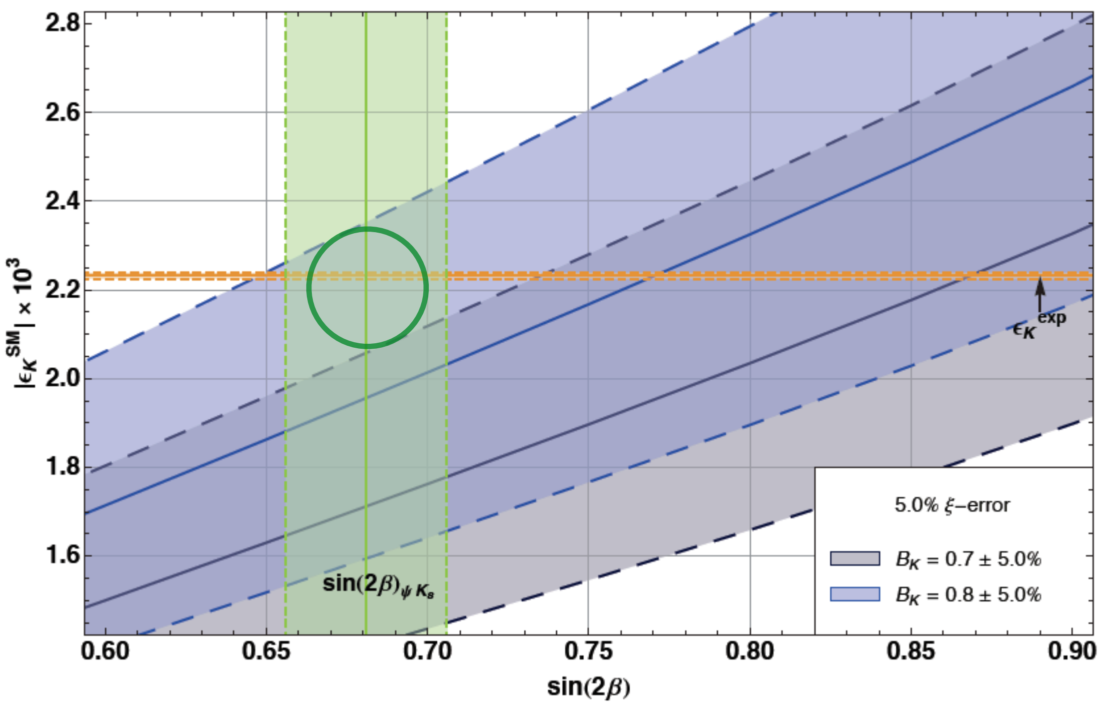

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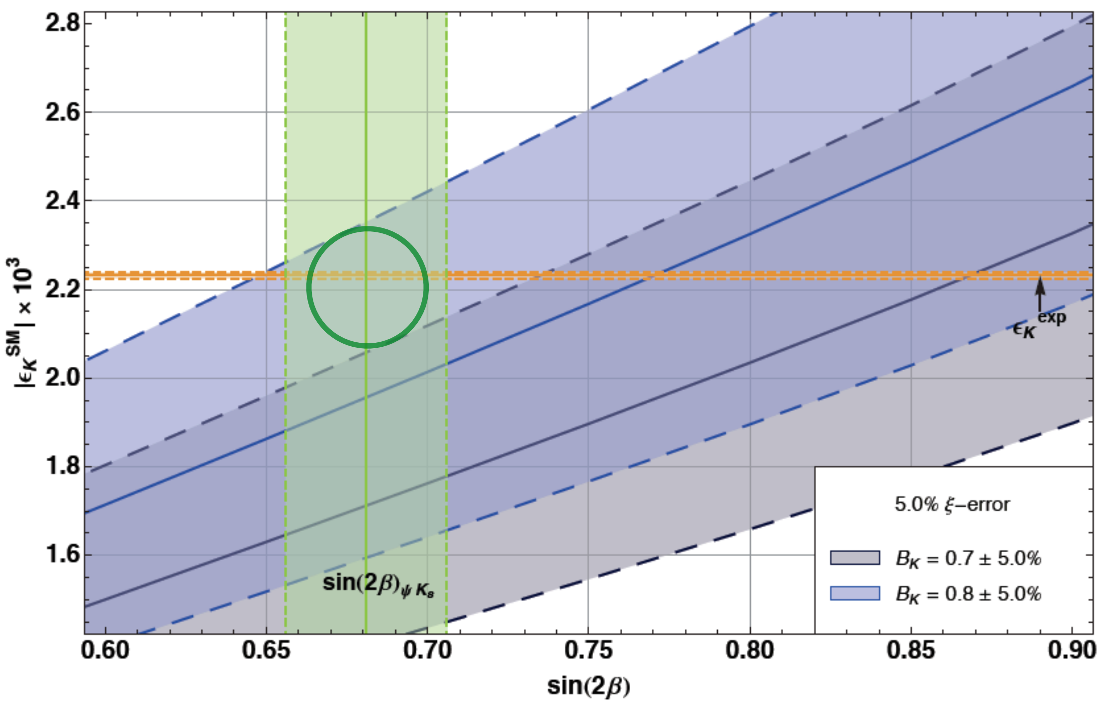

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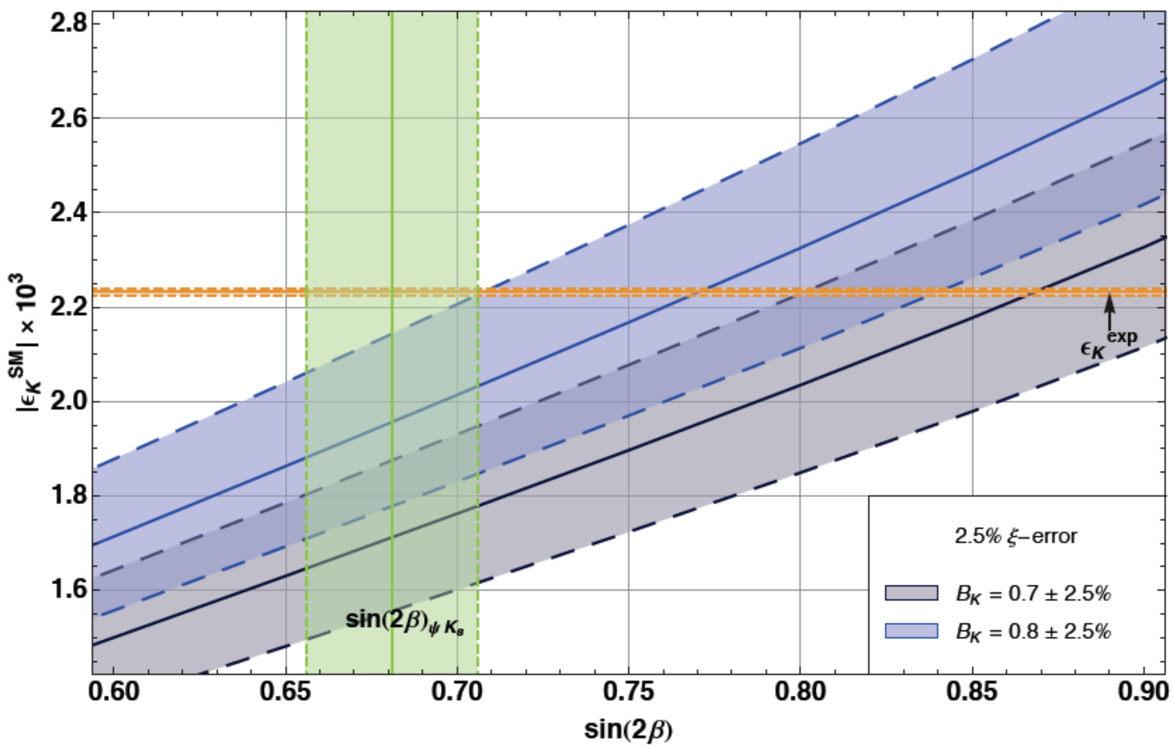

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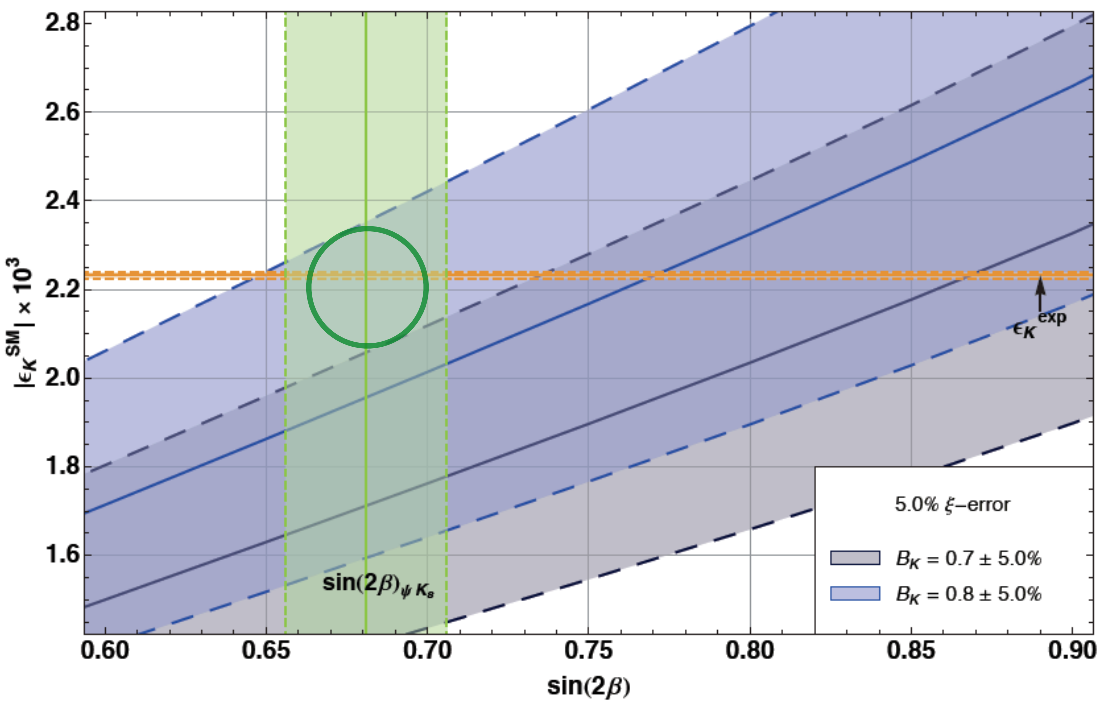

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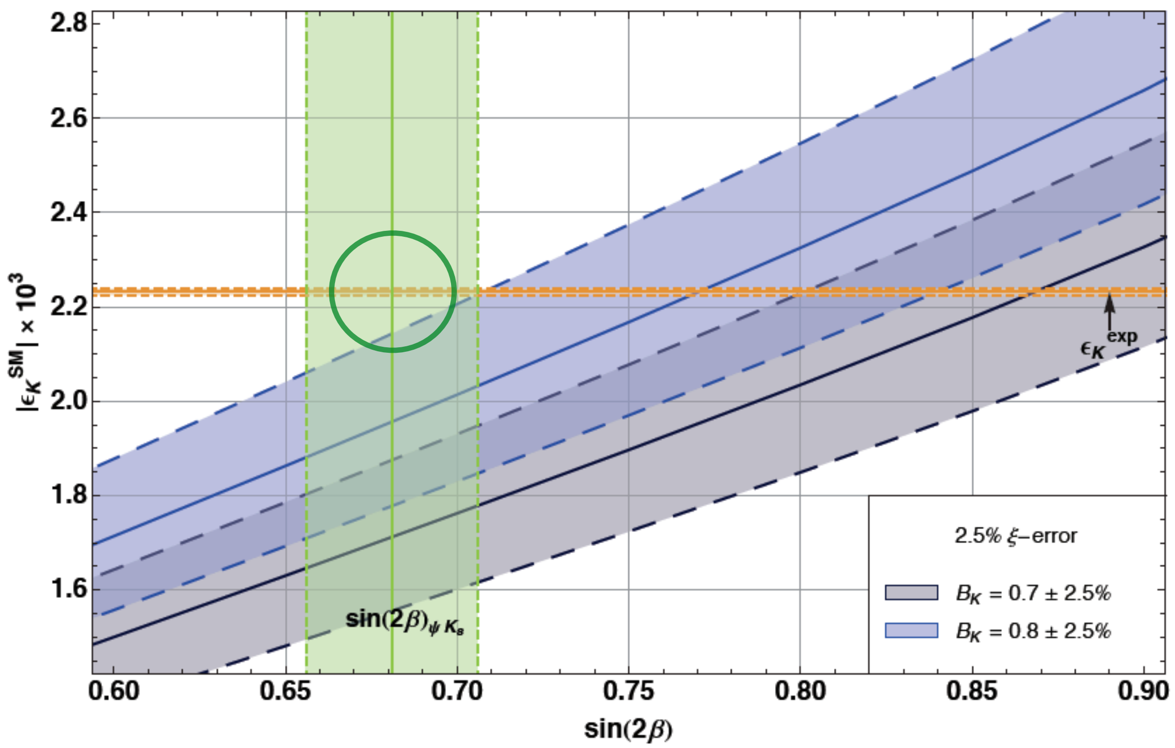

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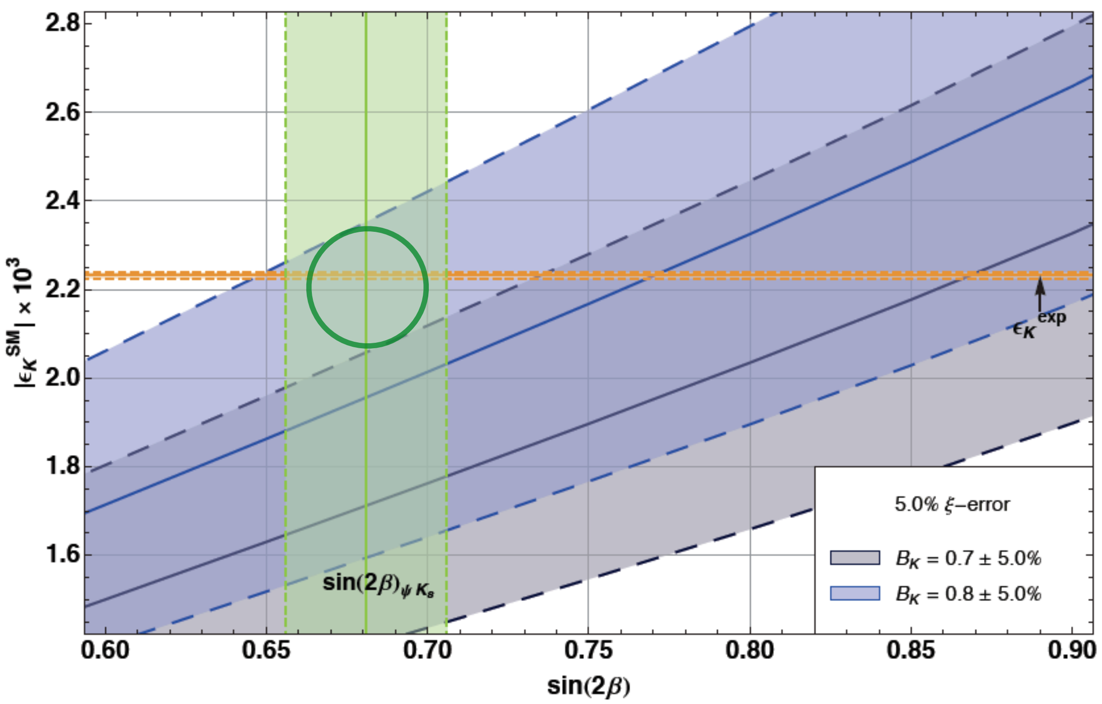

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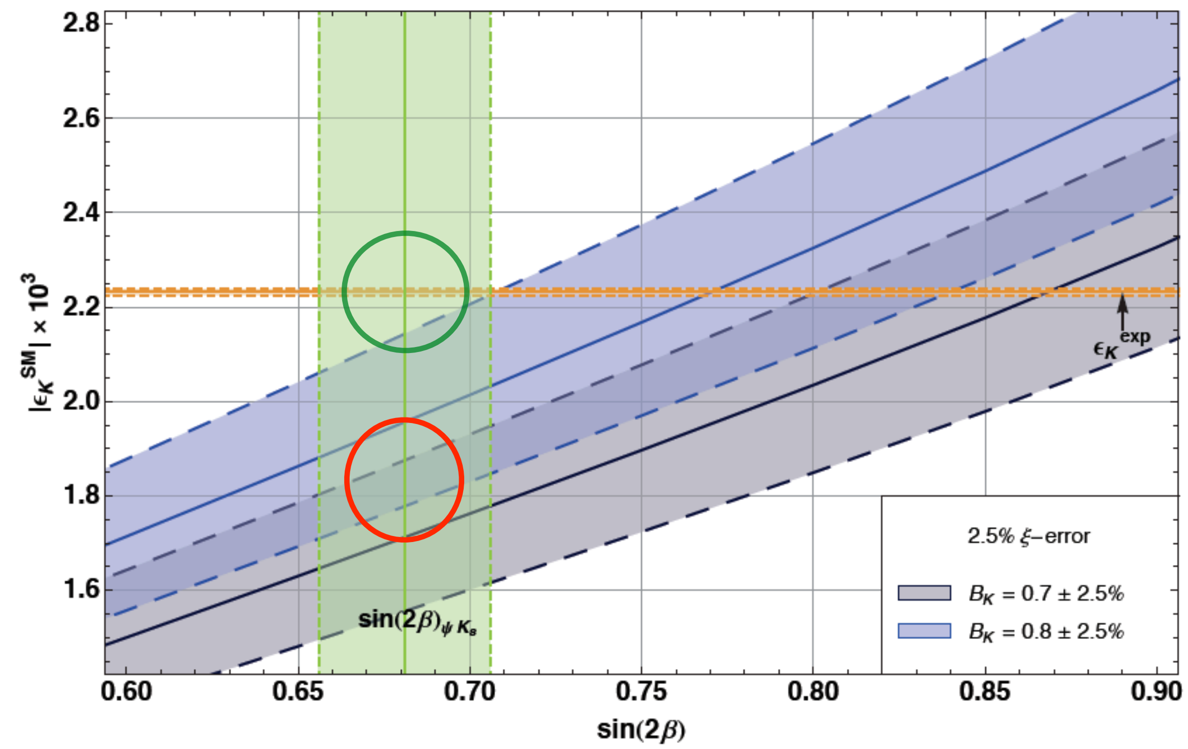

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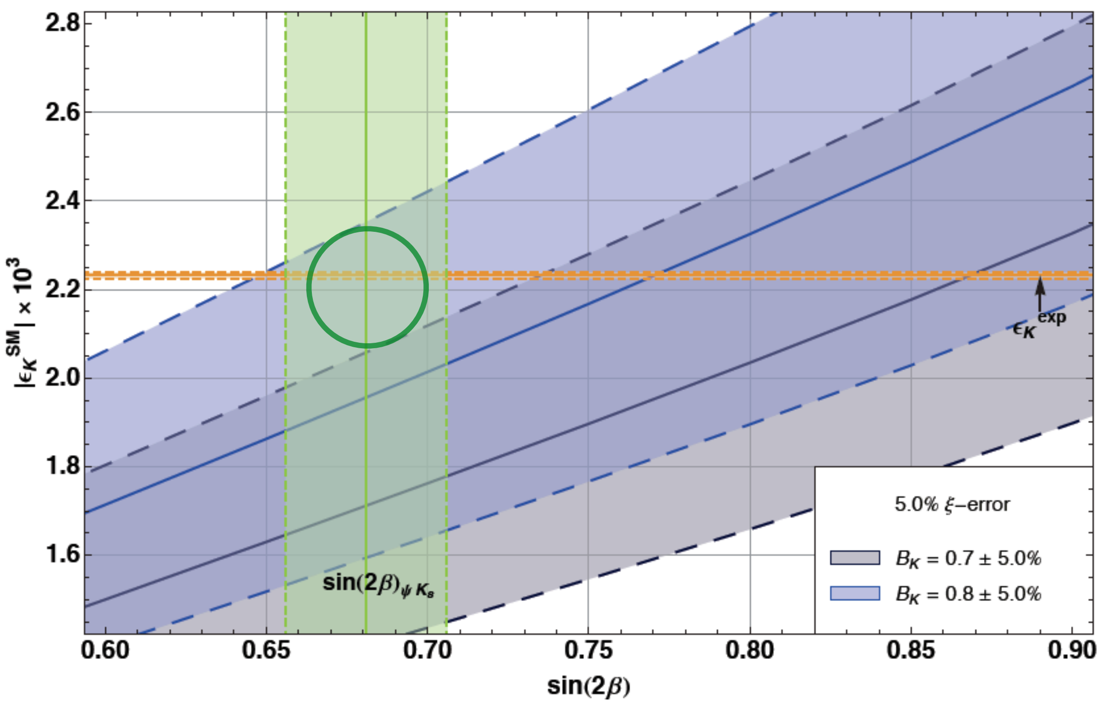

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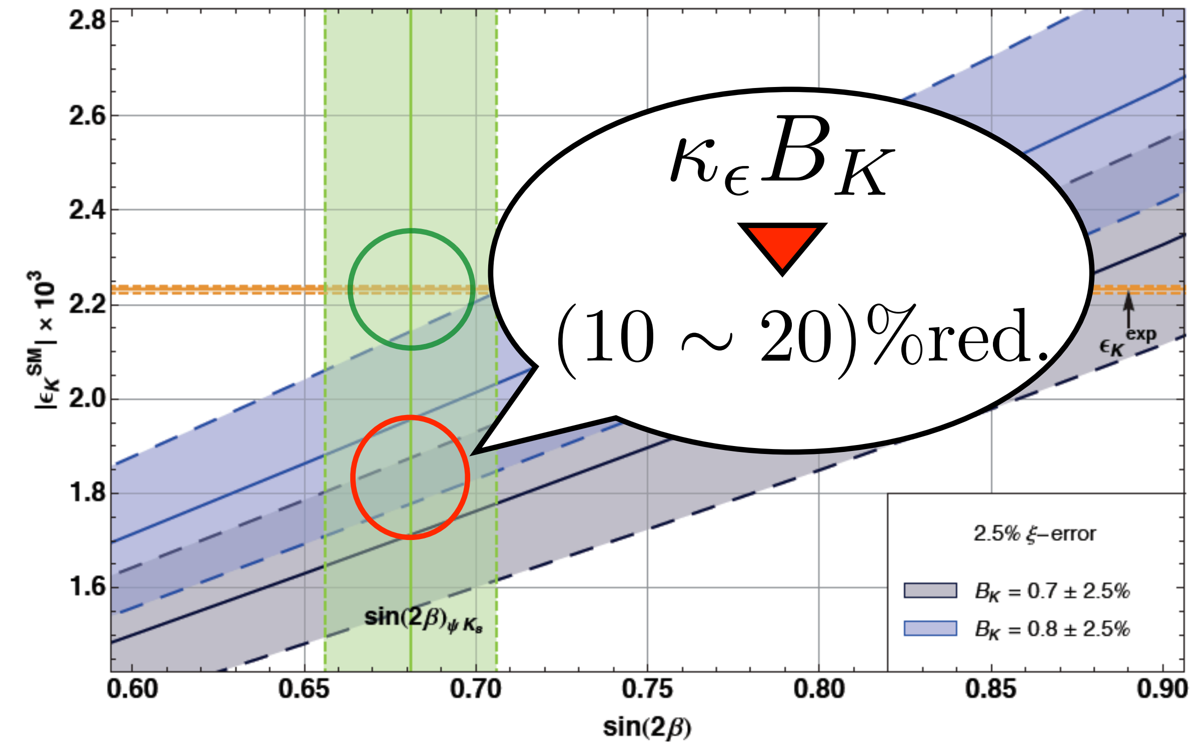

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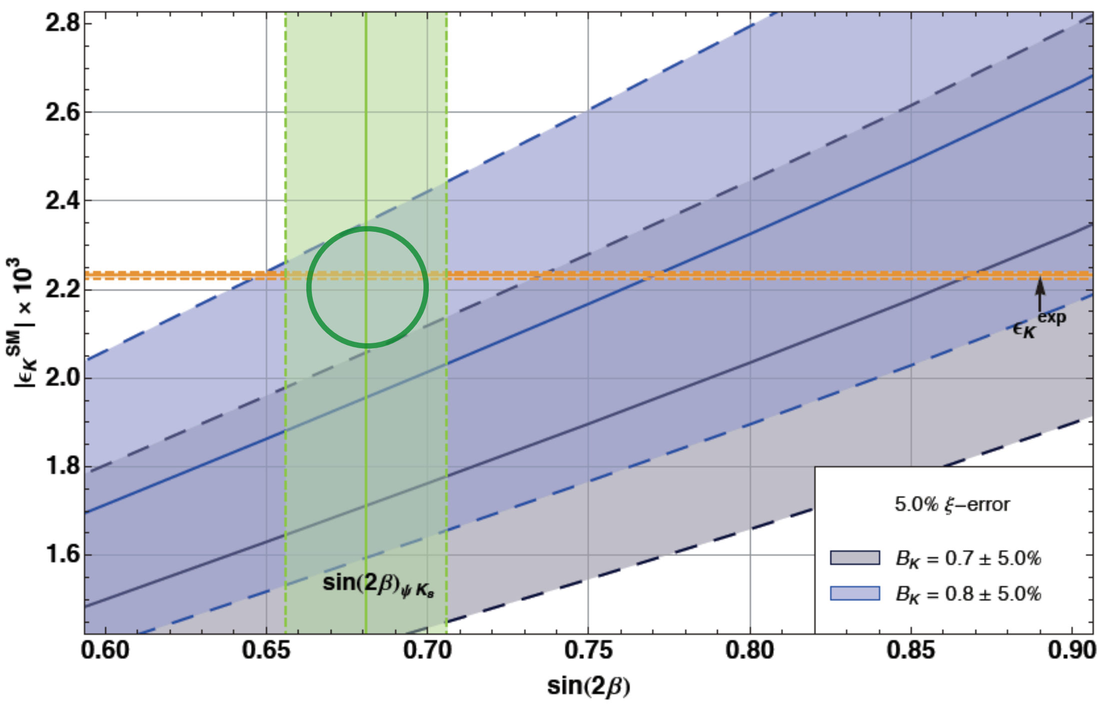

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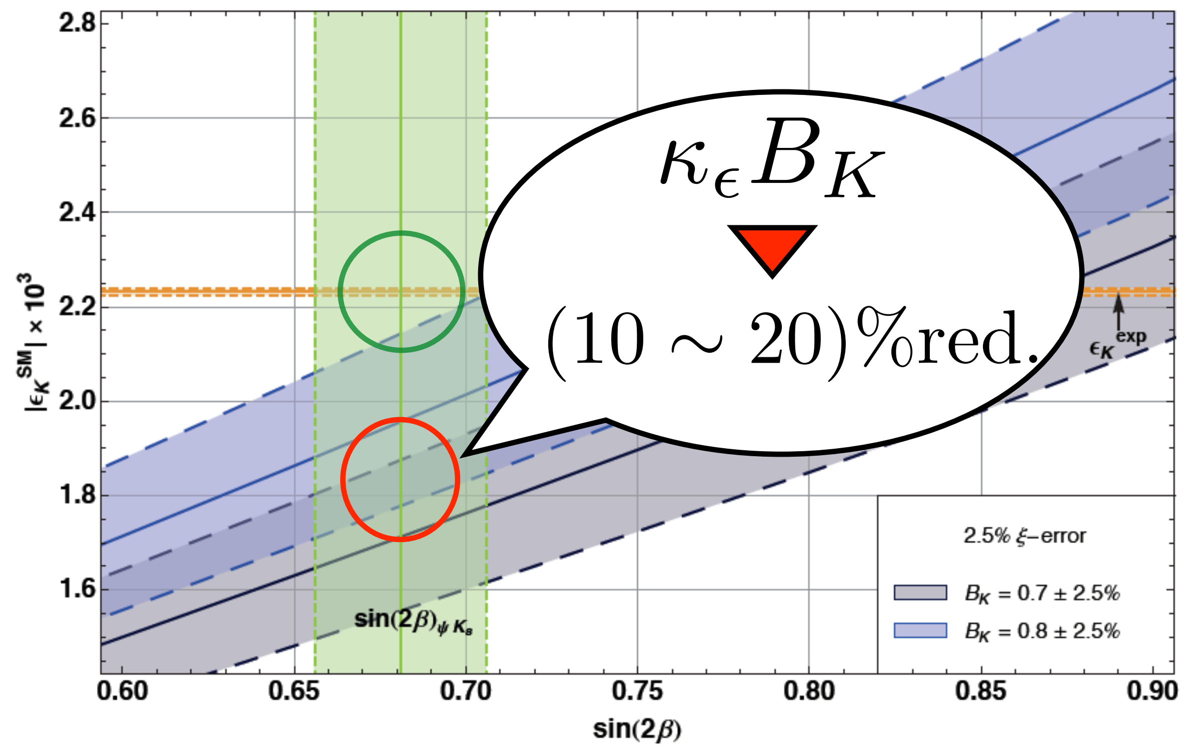

Future "unofficial" lattice result

If you believe in lattice calculation :

- NP in K system (UED,...)?
- NP in B system (new B mixing phase,...)?
- Mix of the two ?
- Increasing the number of quark families ?
- ...

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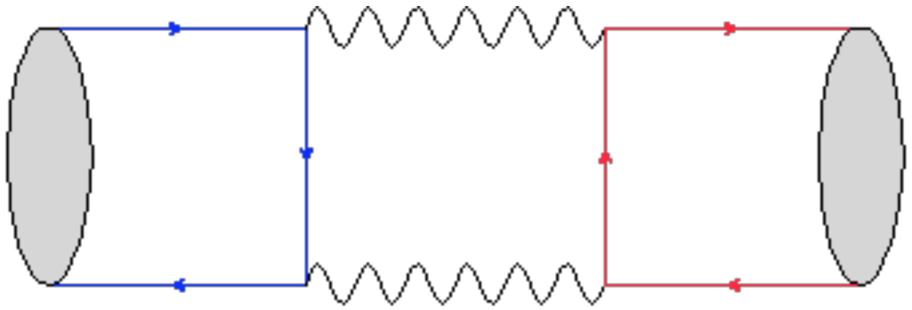

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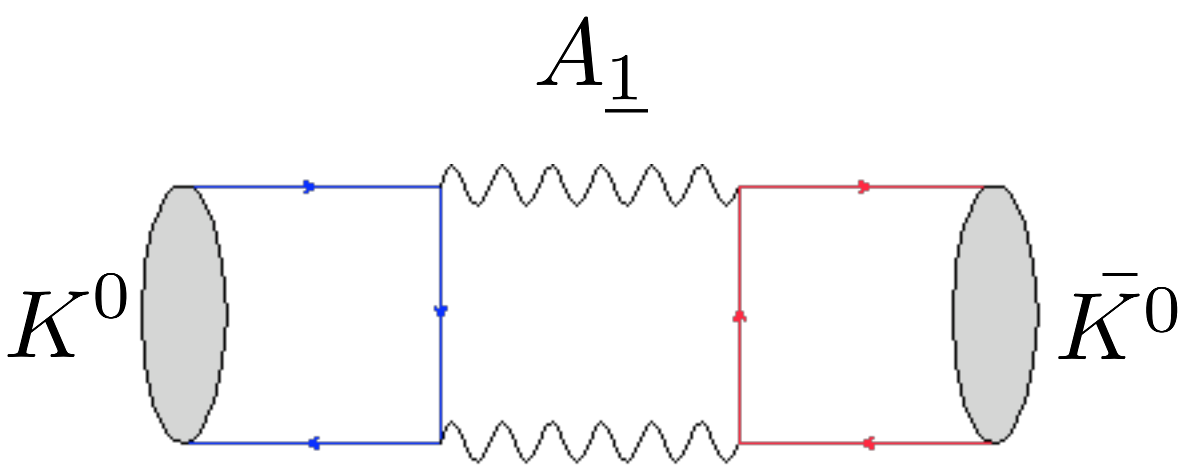

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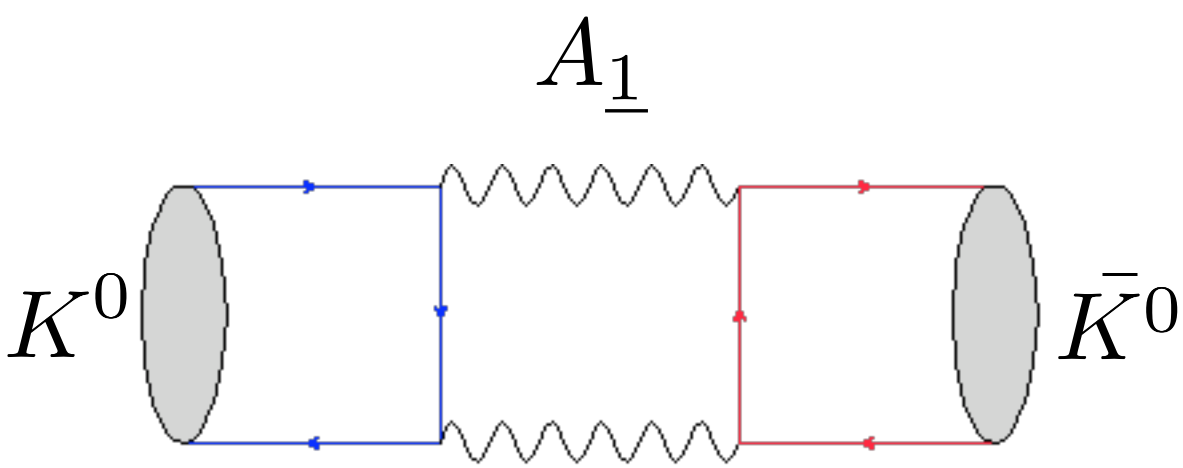

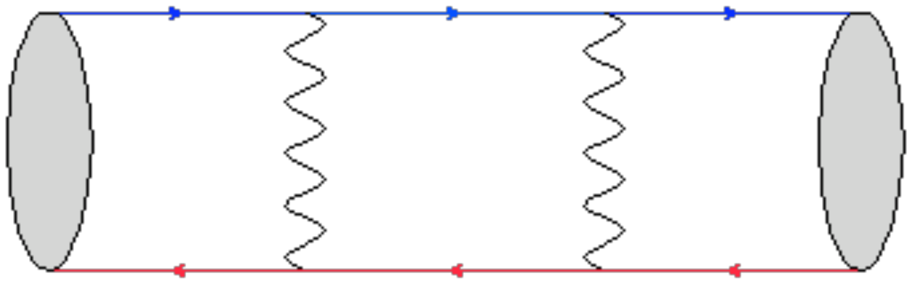

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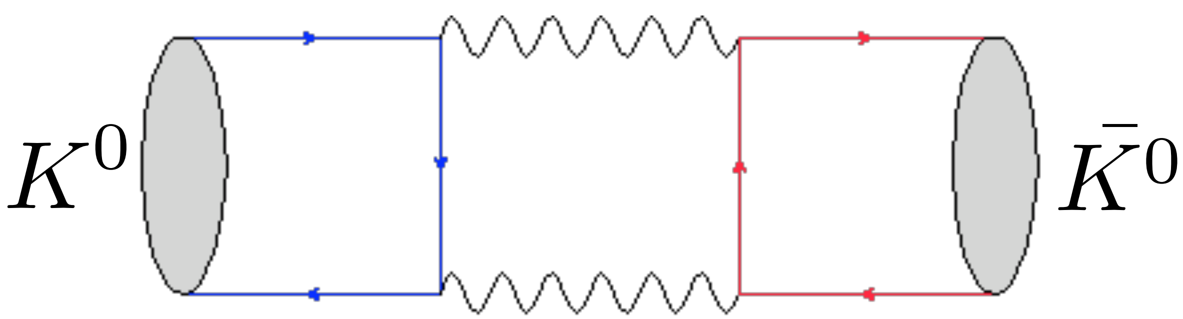
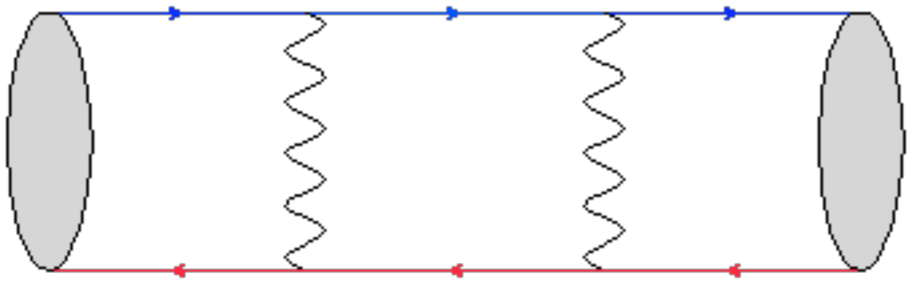


$B_{\underline{1}} + B_{\underline{8}}$



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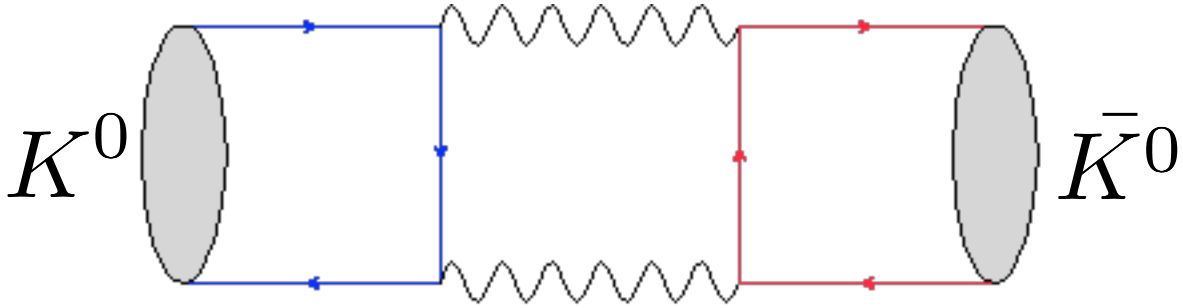

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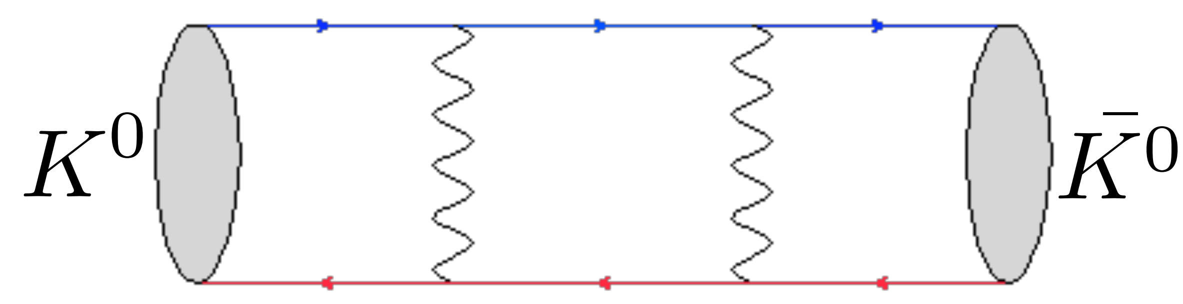

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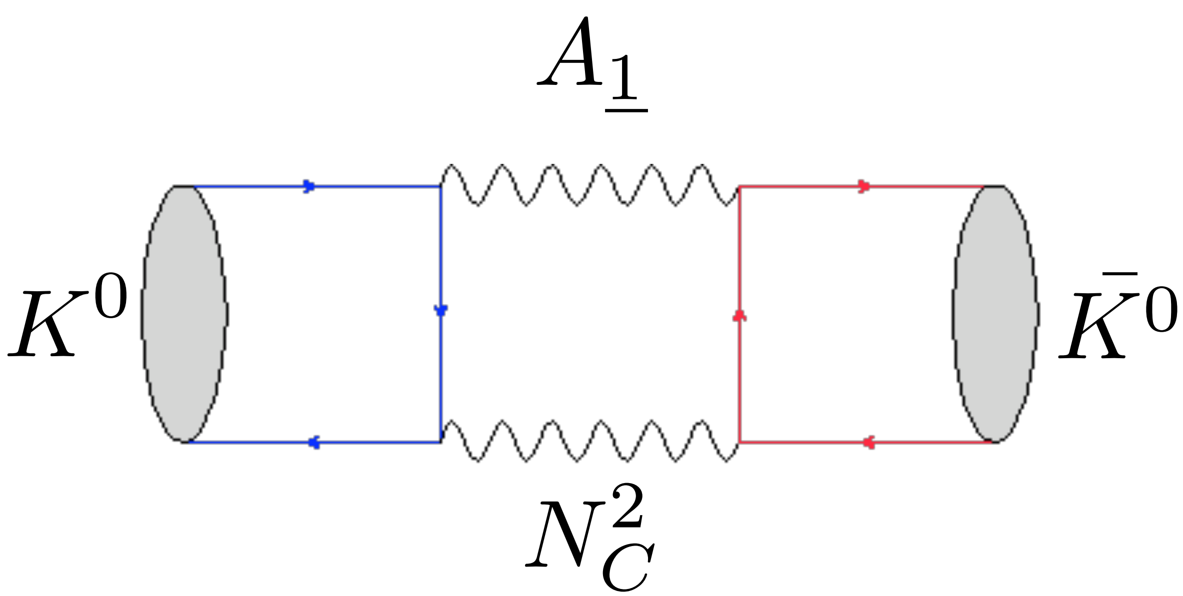

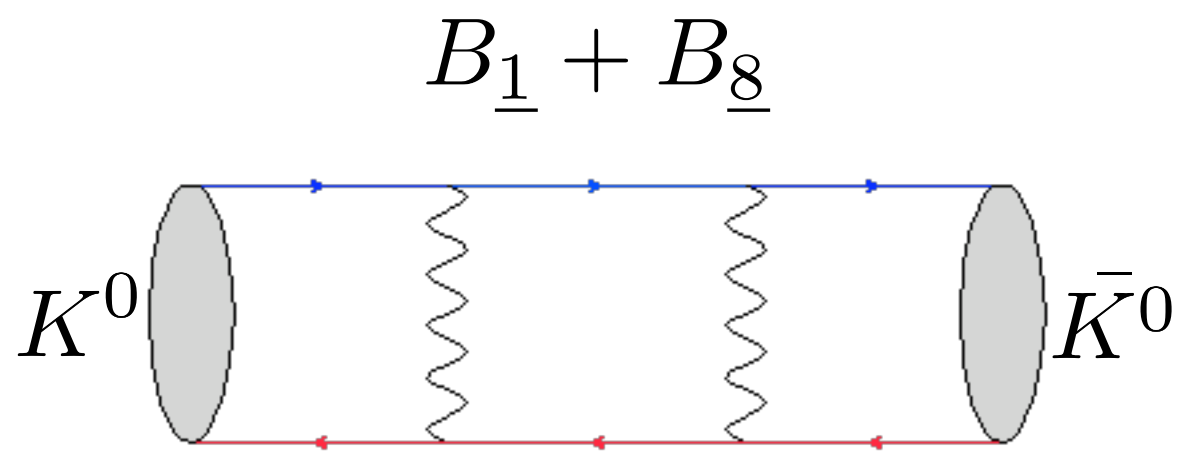

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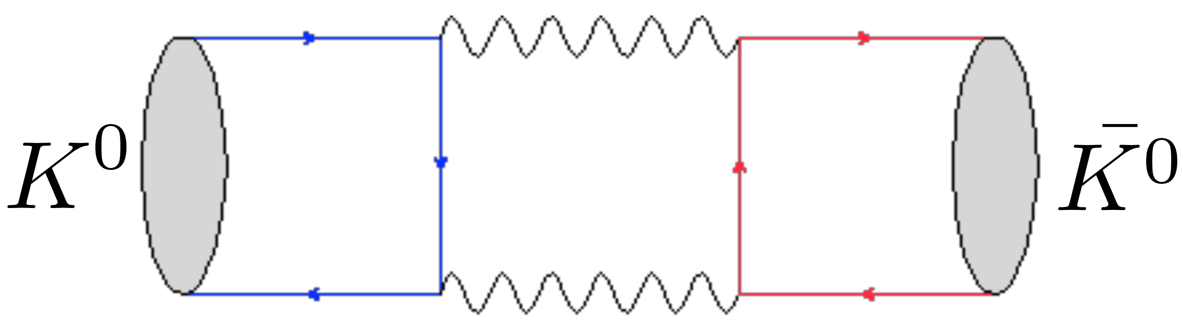

N_C^2

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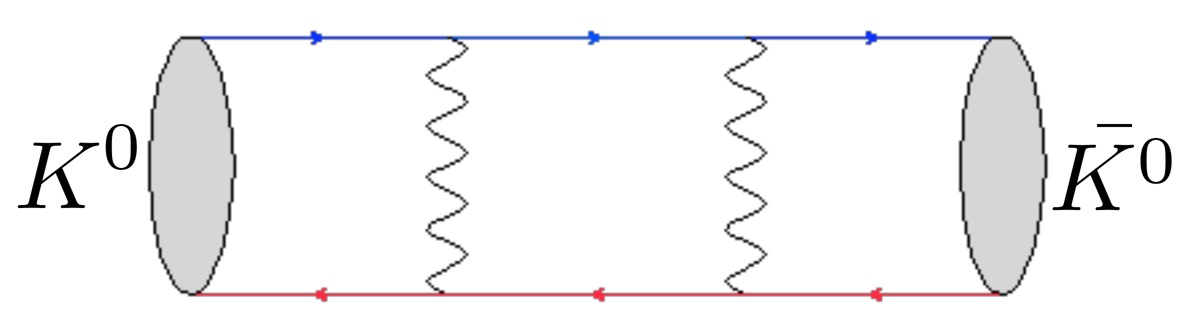

$N_C^2 \times 1/N_C = N_C$

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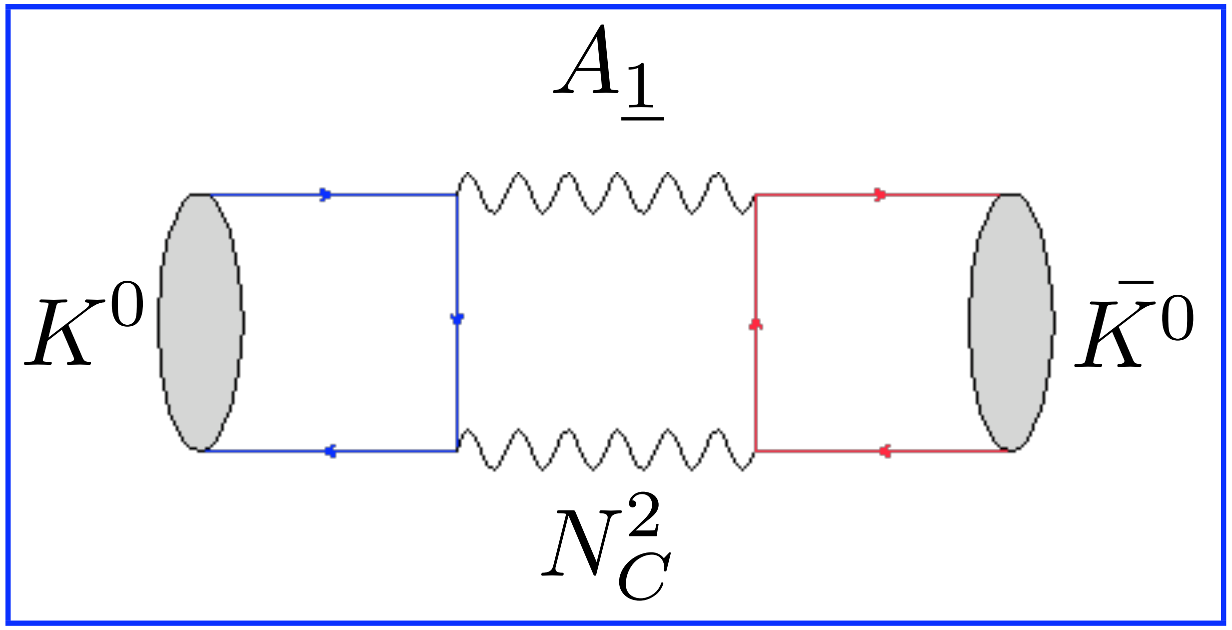
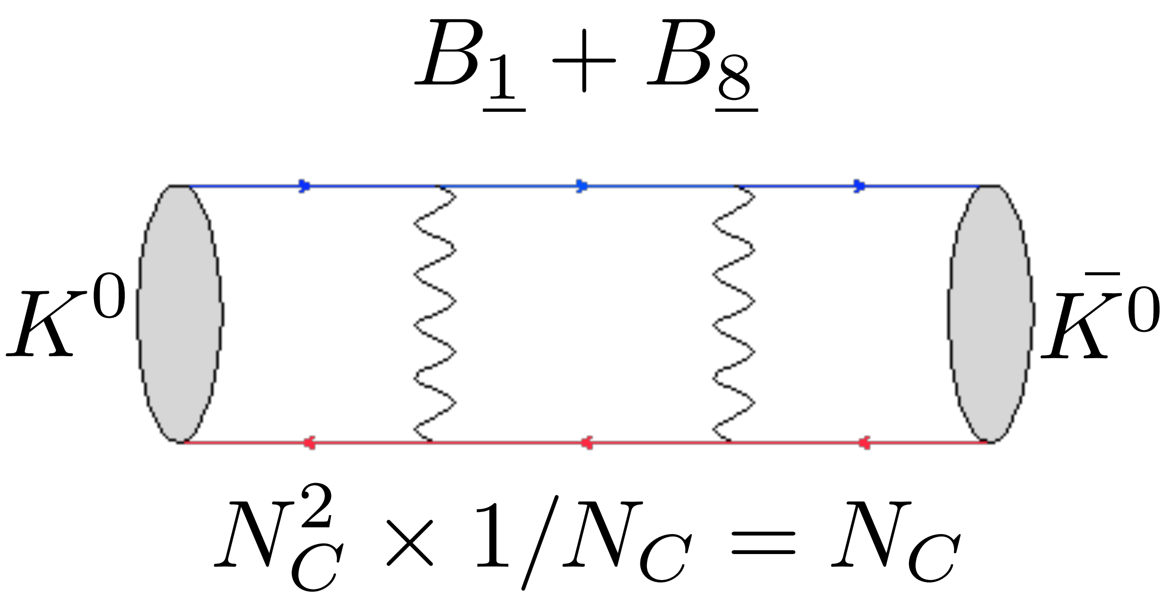


$\chi PT : B_K = 0.75$



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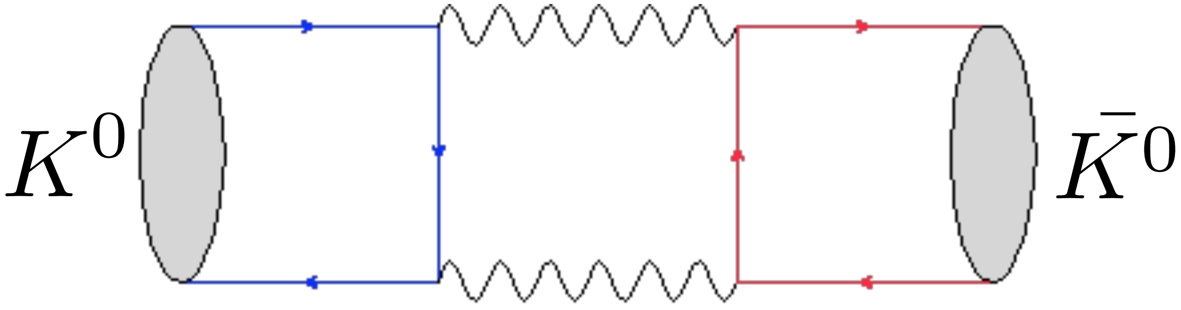

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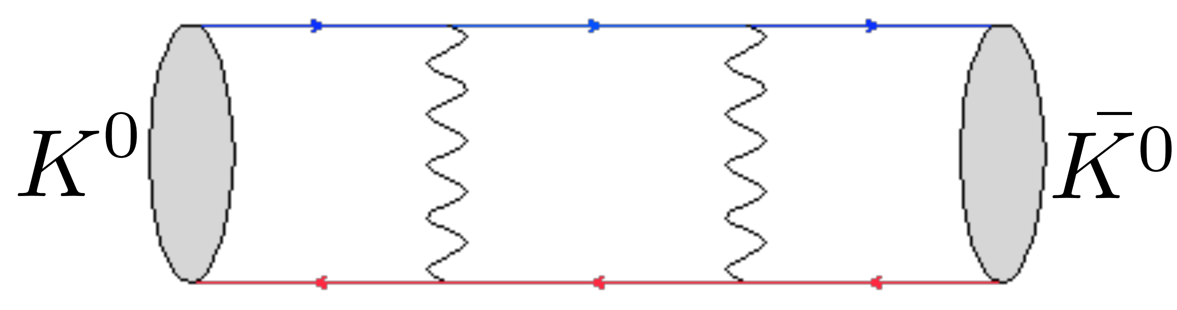

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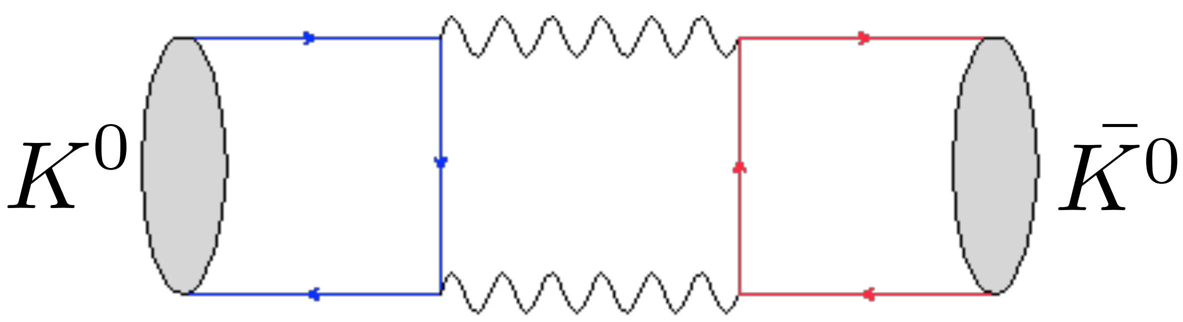

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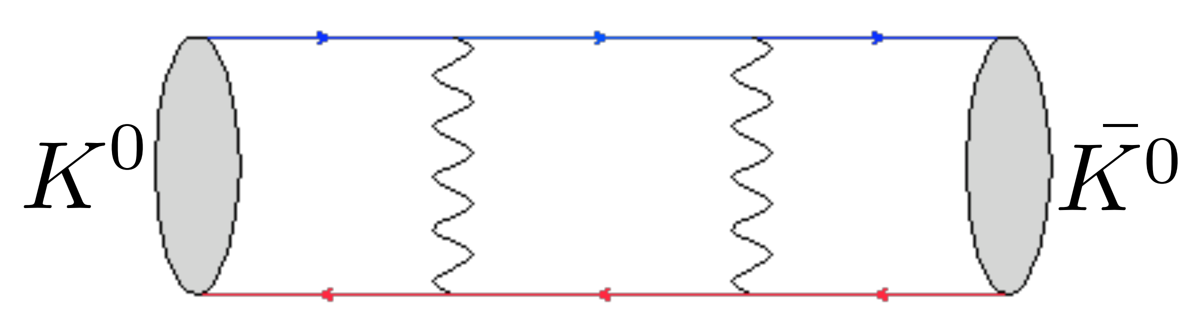

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Naively we expect that : $A_{\underline{1}} + B_{\underline{1}} \sim \left(1 + \frac{1}{N_C}\right)$

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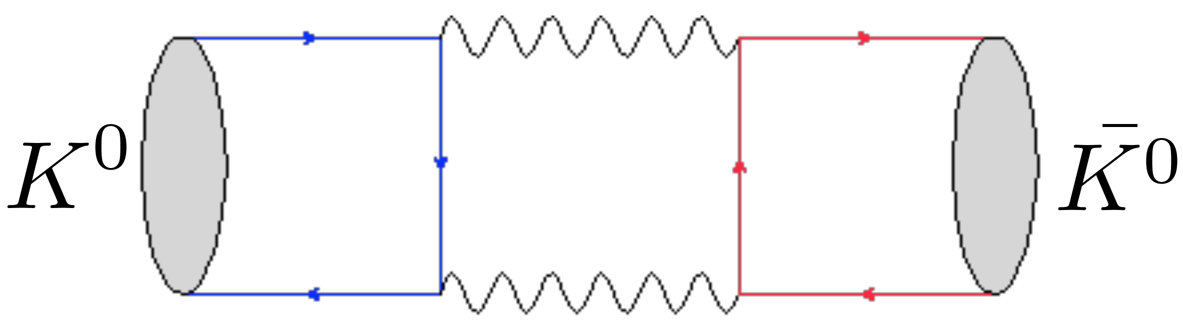
Could we at least interpret their result ?

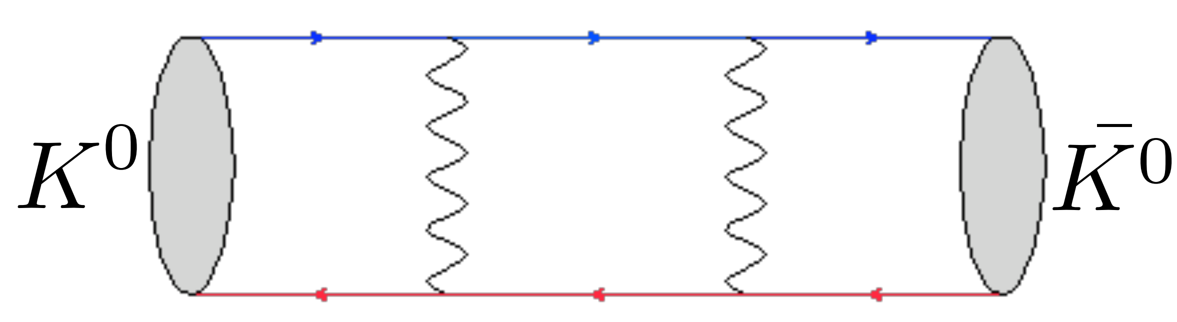
$A_{\underline{1}}$



N_C^2

$\chi PT : B_K = 0.75$

$B_{\underline{1}} + B_{\underline{8}}$



$N_C^2 \times 1/N_C = N_C$

$\text{Lattice} : B_K \approx 0.72$

Naively we expect that : $A_{\underline{1}} + B_{\underline{1}} \sim \left(1 + \frac{1}{N_C}\right)$

So, why : $B_{\underline{8}} \sim -\left(\frac{1}{N_C} + \epsilon\right)$???

Thank you.