Summary of “Measuring the Primakoff reaction and $F_{K2\pi}$ with AMBER phase-II”

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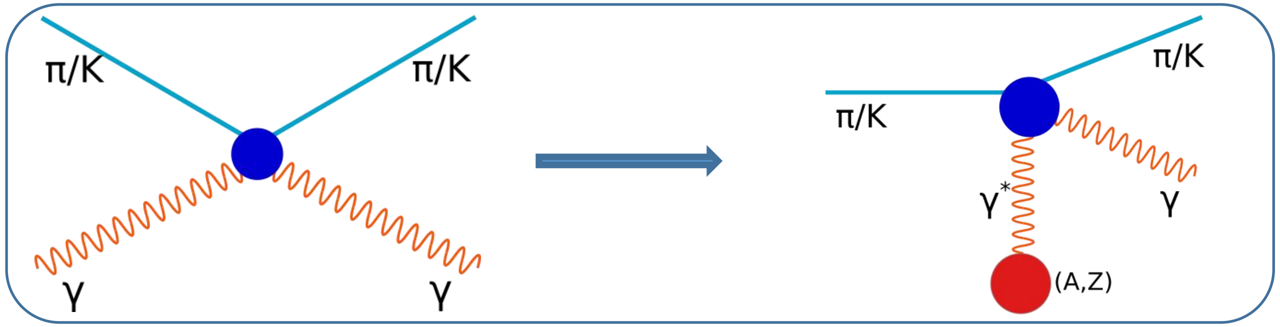
Perceiving the EHM, AMBER@CERN, round-table discussion, April 30, 2021

Kaon polarizabilities



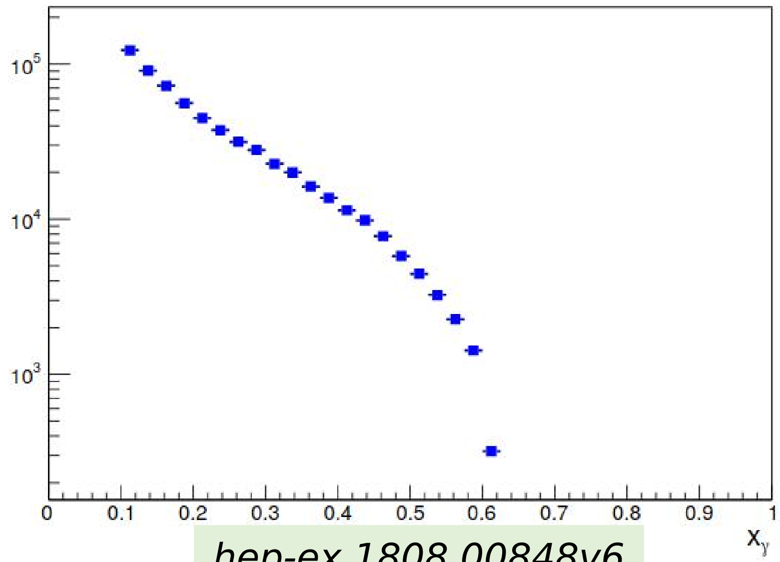
A way to test applicability regions of χPT and other low-energy models

World data so far: G. Backenstoss et. al, *Phys.Lett.43B, 5 (1973)*
$|\alpha_K| < 200 \times 10^{-4}$ fm³ (90% confidence)

Expected statistical accuracy on **α_K - β_K: (AMBER, 1 year)**
$\sigma_{stat} = 0.03 \times 10^{-4}$ fm³ ($\alpha_K + \beta_K = 0$):

Effects to be considered:
- background from $\pi^0 K^-$
- background from γK^-, but produced via strong interaction

Also possible to measure:
- α_K and β_K separately
- quadrupole polarizabilities



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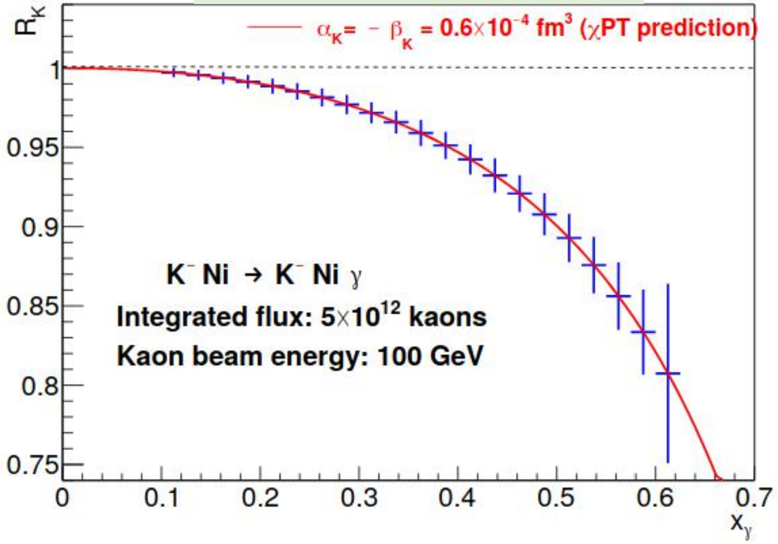
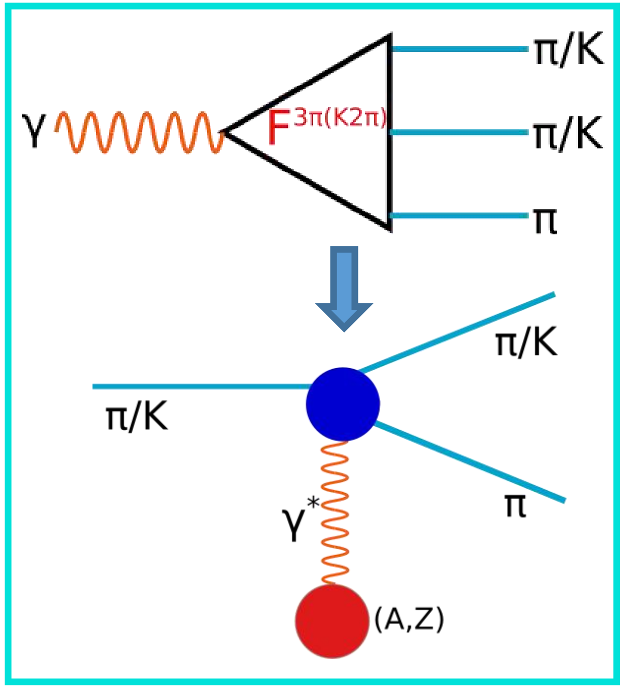


Theory predictions:
χPT (one-loop): $\alpha_K - \beta_K = 1.16 \times 10^{-4}$ fm³
QCM: $\alpha_K - \beta_K = 3.6 \times 10^{-4}$ fm³

Chiral anomaly with kaons



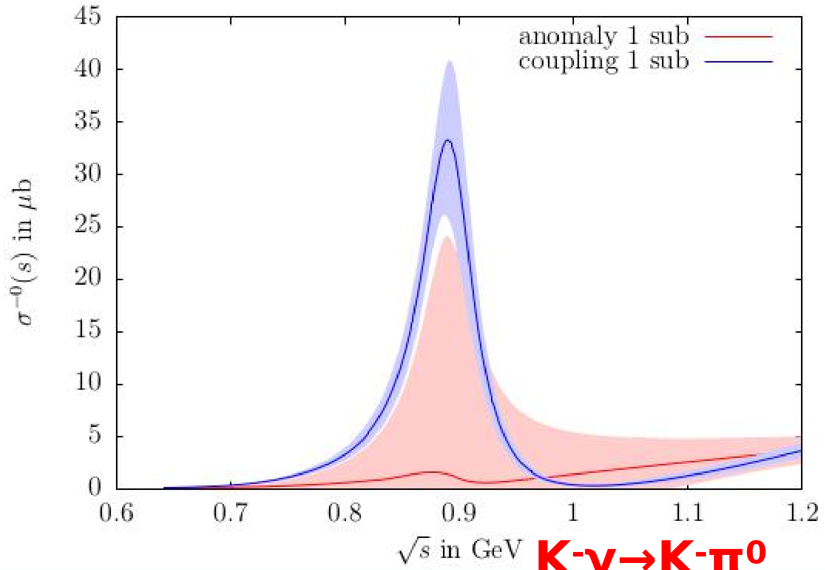
Theoretical prediction from chiral anomaly:

$$F_{K2\pi} = F_{3\pi} = \frac{e}{4\pi^2 F_\pi^3} = (9.78 \pm 0.05)\ \mathrm{GeV}^{-3}$$

- Test of χPT, also input for lattice QCD calculations *(PoS CD2018, 076 (2019))*
- Input from processes $K^-\gamma \to K^-\pi^0$ and $K^-\gamma \to K^0\pi^-$

M. Dax, D. Stamen, B. Kubis *Eur. Phys. J. C (2021)81:221*

- Dispersive framework for all charge channels
- Fix subtraction constants using data on $K^-\gamma \to K^-\pi^0$ and $K^-\gamma \to K^0\pi^-$ → extract chiral anomaly
- Allows to utilize data up to s ~ (1.2 GeV)^2
- Allows to obtain radiative coupling of K*(892)



$K^-\gamma \to K^-\pi^0$

Eur. Phys. J. C (2021)81:221

Effects to be considered:

- background from $K^-\pi^0\pi^0$
- background from $K^-\pi^0$ produced via strong interaction

V.S. Burtovoy, Phys.Part.Nucl., 2017, Vol. 48, No. 6.

N_{strong} ~ $N_{coulomb}$ @ p=17.7 GeV/c beam → ~10% contribution @ ~100 GeV