Finite width effects & K*-meson DAs

CP3 Origins
Cosmology & Particle Physics

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1) **K*-meson distribution** amplitude in B→K*ll

2) The **pragmatic solution**

3) Comment on **Tetraquarks** in B→K*ll

K*-Distribution amplitude in B→K*ll et al

- Large recoil (q^2=0): K* fast ⇛ light-cone methods (LCSR,QCDF)

$$\langle K^*|H^{\rm eff}|B\rangle = \sum_i \int_0^1 du\, T_i(u,\alpha_s,m_b,..)\phi_i(u)$$

Reflect on DA from def:

$$\langle K^*(p,\eta)|\bar{u}(z)\gamma_\mu d(0)|0\rangle = f_{K^*} p_\mu \frac{\eta^* z}{pz} \int_0^1 du\, e^{iupz} \phi^{\|}(u,\mu) + \ldots$$

$$\phi^{\|}(u,\mu) = 6u\bar{u}(1 + a_1 C_1^{(3/2)}(2u-1) + \ldots$$

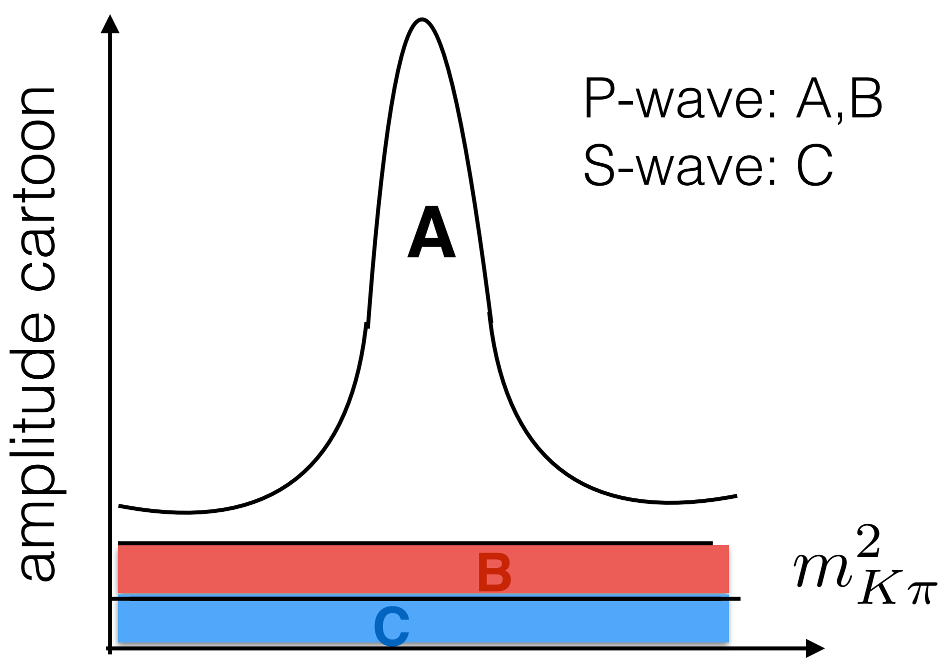
Non-perturbative parameters characterising how the quarks distributed in K*.

How are NP-para. defined and what do we know?

K* in τ→ K*(→Kπ)ν

reiteration of argument in
Bharucha, Straub, RZ'15

- f_{K^*} known from* $\tau \to K^*(\to K\pi)\nu$
- **experimentalist** will look at **$m_{K\pi}$ -plot** and trying to fit it with **amplitude-ansatz**



(1) subtract S-wave **(part C)**

(2) K*-Breit-Wigner' **(part A)**
difficult to disentangle from
Kπ-continuum **(part B)**
- not well-defined?
- **but** also **not necessary**

f_{K^*} effective parameter of
part A,B in K*-mass window

*exact analogue of $F_{K^*\pi}(q^2)$ form factor in Javier's presentation

useful definition since in K* in B→ K*(→Kπ)ll

- **experimentalist** will look at **$m_{K\pi}$ -plot** and trying to fit it with an **amplitude-ansatz**

Rule: Use **same ansatz** (subtract S-wave)

- **Caveat:** K*-(DAs) not only described by f_{K^*} but also
  (1) transverse decay constant $f_{K^*}^T$
  (2) higher Gegenbauer moments a_n

- **Assume:**

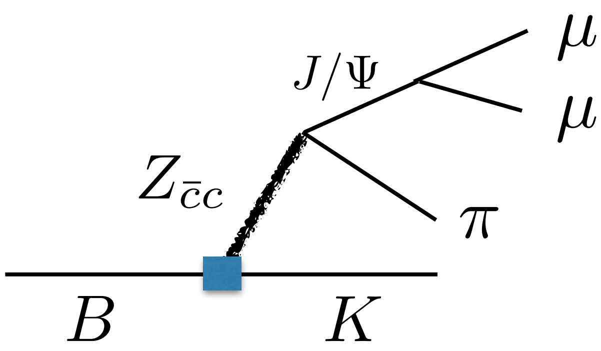
$$\frac{f_{K^*}}{(f_{K^*})_{\mathrm{S}R}} \simeq \frac{f^T_{K^*}}{(f^T_{K^*})_{\mathrm{S}R}}$$

similar a_n's numerically less relevant

- reasonable assumption yet nice to test:
  (a) can't do it in nature as no tensor currents coupled to leptons
  (b) future: could check on lattice (Bricenio, Hansen, cf. Matt's talk)

Tetraquarks bring in additional twist

- Following topology can arise (people begin to realise …)



If (Kπ) in K*-mass window (P-wave) then **miscounted**!
These **tetraquarks** do **not** figure in our **predictions**!

⇒ looking at f_{K^*} from **τ**→ K*(→Kπ)ν imposes itself!

Summary & Conclusions

- Correct definition of K^* (pole on 2nd sheet) can be bypassed **if**

1) Experimentalist use **same** parametrisation for K^* in **both** $\tau \to K^*(\to K\pi)\nu$ and $B \to K^*(\to K\pi)ll$

2) Assume $f_{K^*}/(f_{K^*})_{SR}$ -universality (can be tested)

3) Attention to the tetra quark