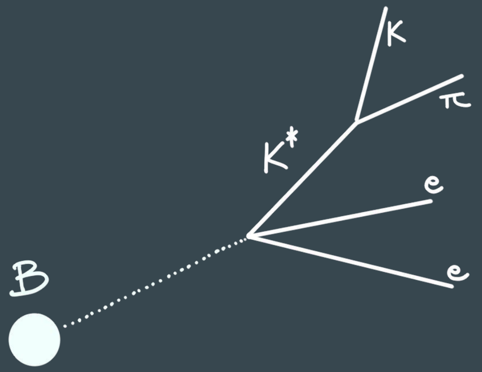
Angular analysis of the $B \rightarrow K^*ee$ decays in LHCb

Aleksandra Snoch

Recontres de Moriond EW 2023

LHCb measures b decays, and this is a rare one



$B \to K^{*}ee$: $BR \approx 10^{-6}$

$B \to K^{*}J/\psi(\to ee)$: $BR \approx 10^{-3}$

Testing Standard Model

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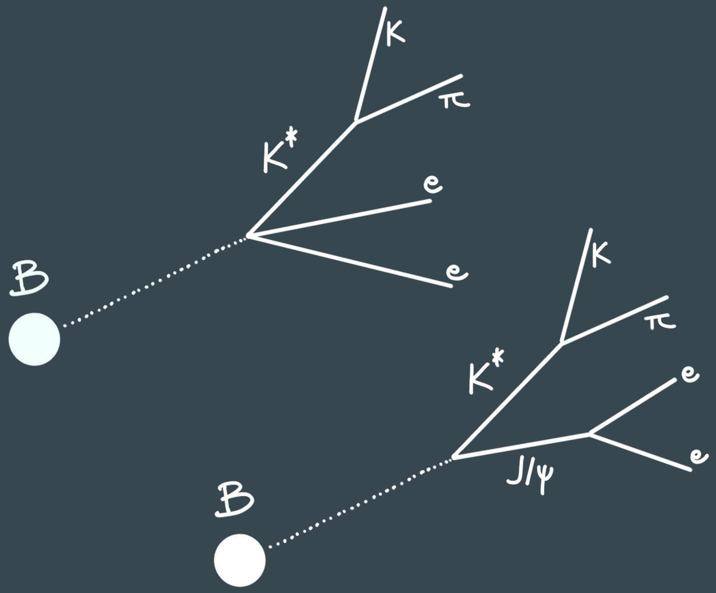

$B \to K^* ee$: BR ≈ 10^{-6}

$B \to K^* J/\psi (\to ee)$: BR ≈ 10^{-3}

Testing Standard Model

How to test it?

$$\frac{1}{\mathrm{d}(\Gamma+\bar{\Gamma})/\mathrm{d}q^2}\frac{\mathrm{d}^4(\Gamma+\bar{\Gamma})}{\mathrm{d}q^2\mathrm{d}\vec{\Omega}} = \frac{9}{32\pi}\Big[\tfrac{3}{4}(1-F_L)\sin^2\theta_K + \underline{F_L}\cos^2\theta_K$$
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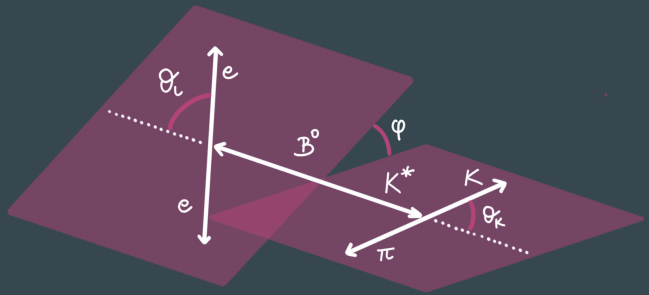
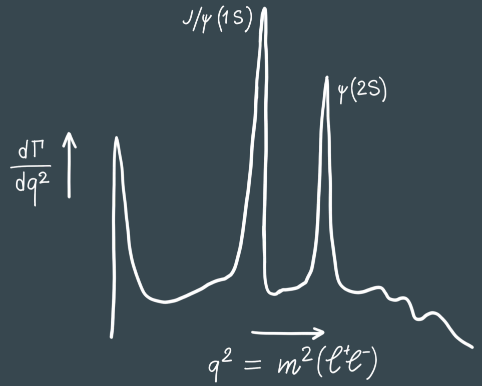
Measuring angular coefficients





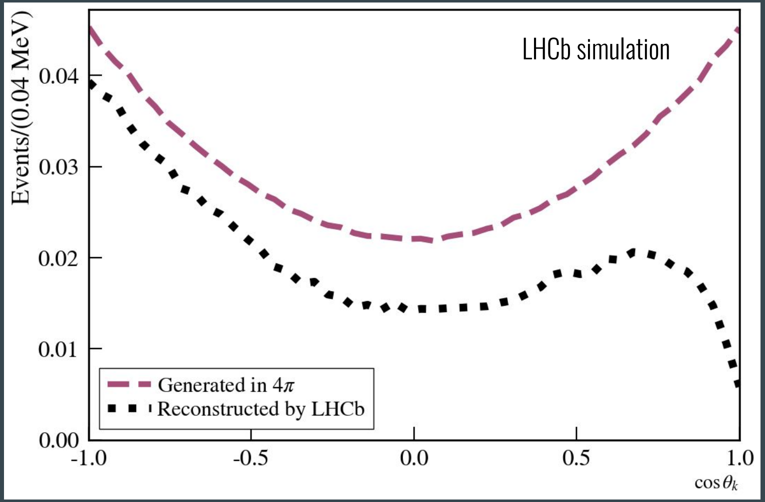
How to look for them?

Fit in B mass, decay angles, $m^2(l^+l^-)$

Challenges:

background parametrization

acceptance parametrization



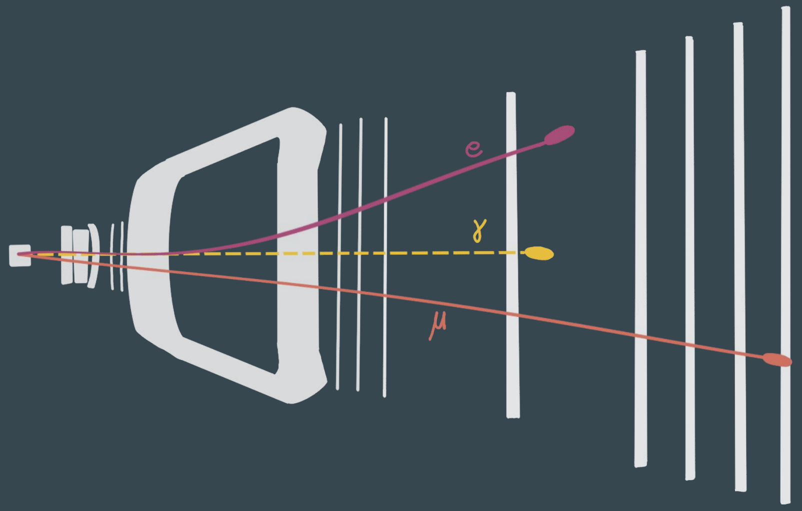
Electrons are challenging

Electrons emit bremsstrahlung

Worse mass resolution
Worse angular resolution

Resolution included in efficiency

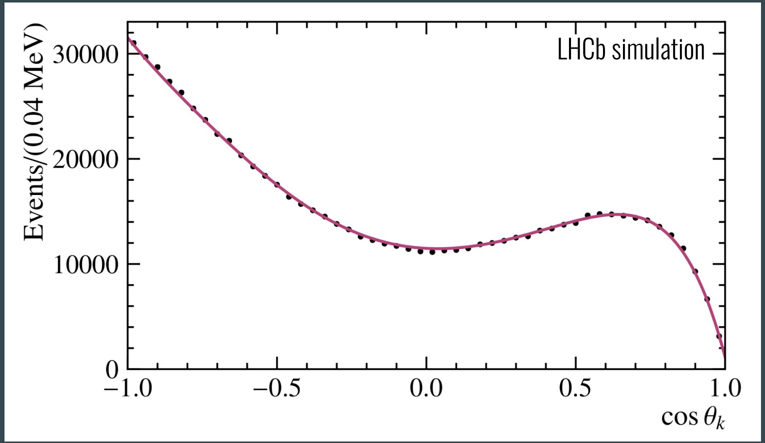
Focus on $B \to K^* J/\psi (\to ee)$



How to parametrize the acceptance?

Efficiency derived from simulated data

$$\epsilon(\cos\theta_\ell, \cos\theta_K, \phi, q_c^2) =$$
$$= \sum_{klmn} c_{klmn} L_k(\cos\theta_\ell) L_l(\cos\theta_K) F_m(\phi) L_n(q^{2\prime})$$



Full fit to B→K*J/ψ(→ee) agrees with results from B→K*J/ψ(→$\mu\mu$)

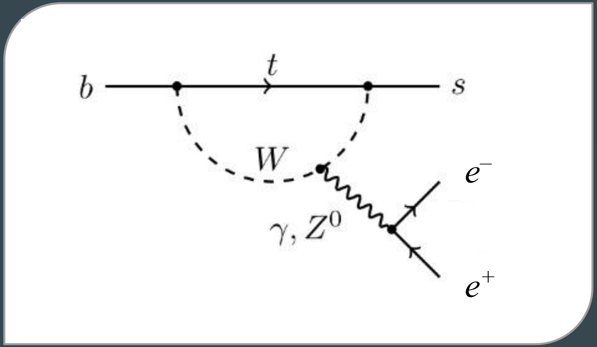
Take me home

$b \to sll$:	great way to test Standard Model
angular analysis:	measuring angular coefficients
$B \to K^*ee$:	the efficiency is well understood

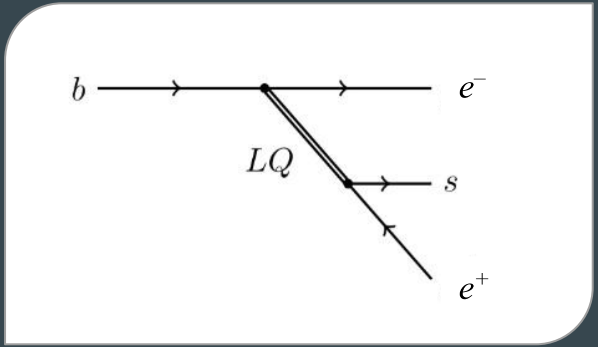
THE END

Testing Standard Model

Standard Model



Leptoquarks?



HOW?

How to test it?

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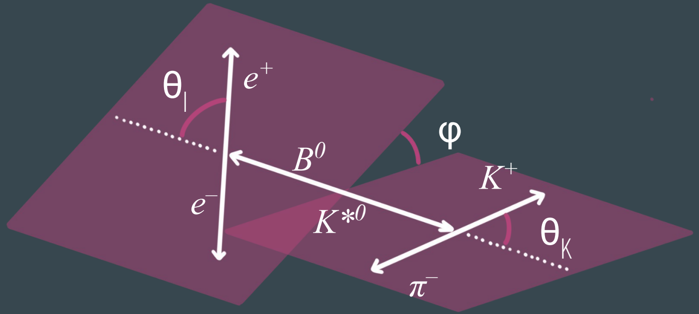
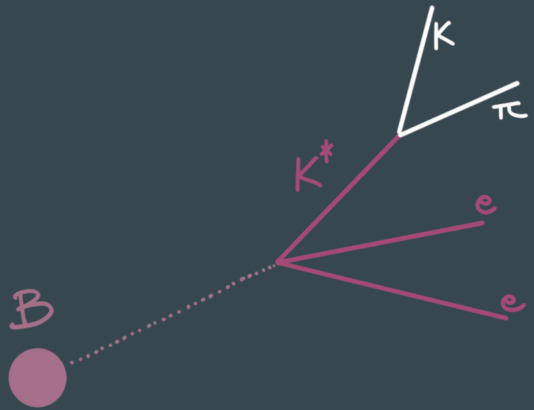


B⟶K*ee: compare with SM

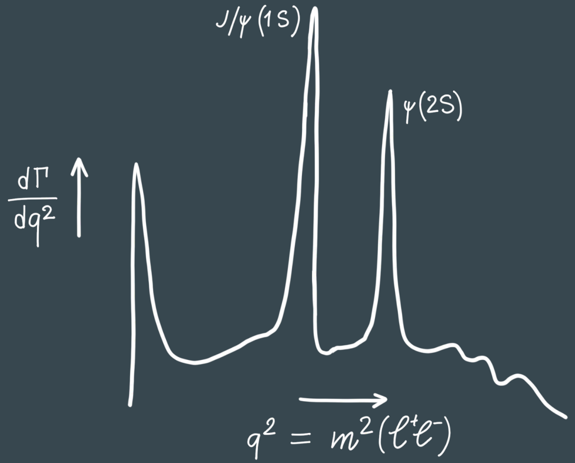
B⟶K*J/ψ: compare with B⟶K*$\mu\mu$

LHCb measures b decays, and this one is a rare one



$B \to K^*ee$: BR ≈ 10^{-6}

$B \to K^*J/\psi$: BR ≈ 10^{-3}



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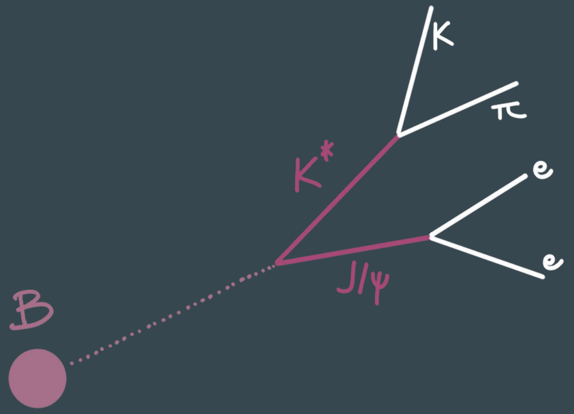

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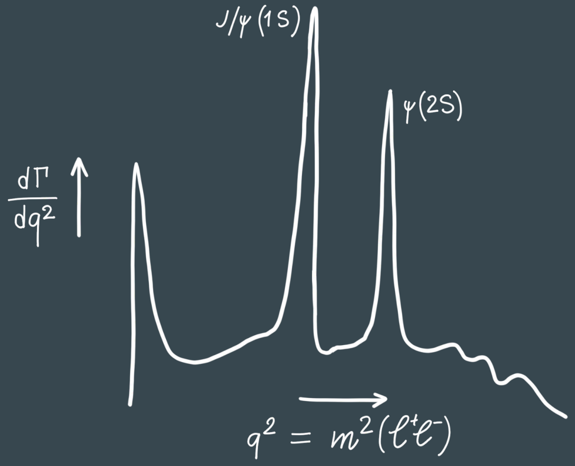


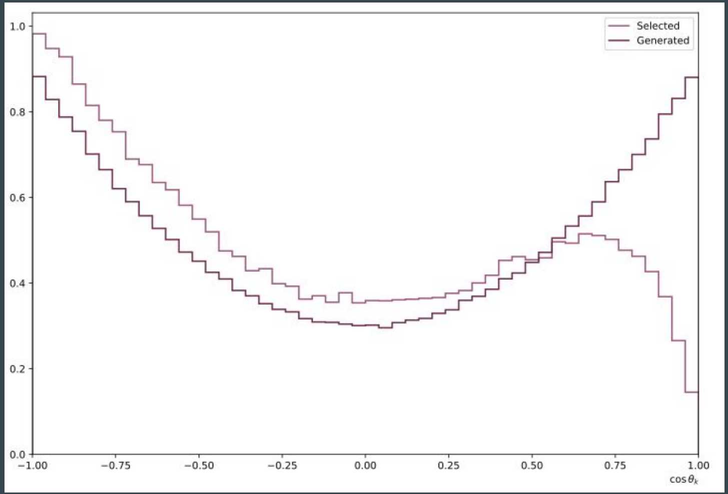
Where to look for them?

Fit in B mass, decay angles, $m^2(l^+l^-)$

Two challenges:

- background parametrization
- acceptance parametrization

Focus on $B \to K^* J/\psi$

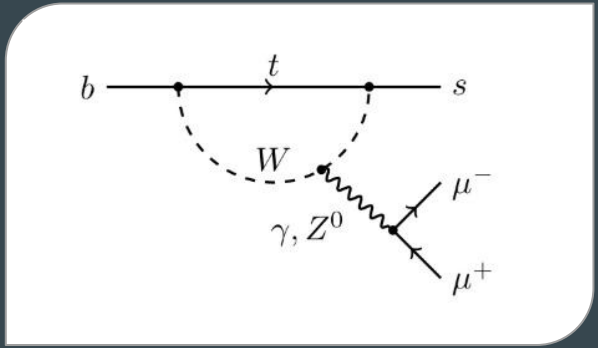


LHCb measures b decays, and this one is a rare one

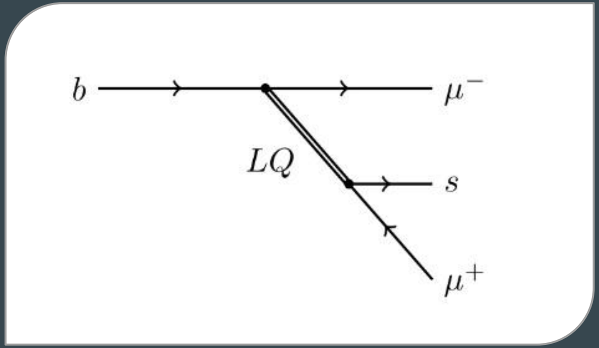
$B \rightarrow K^*ee$: BR = 1.03+0.19-0.17 x 10 $^{-6}$

$B \rightarrow K^*J/\psi$: BR = 1.27 +/- 0.05 x 10 $^{-3}$

Standard Model



Maybe leptoquarks?



How to measure that?

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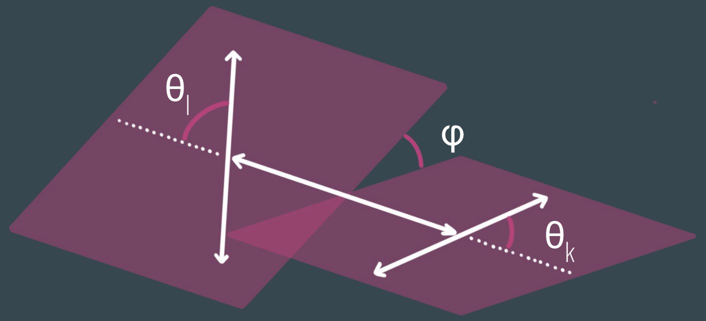

different amplitudes give different distributions of angles and q2
-> angular analysis will show them

we look for differences in distributions of angles and q2