Discussion on $b \to u/s$ exclusive decays: Theory topics

Alexander Khodjamirian (Universität Siegen)

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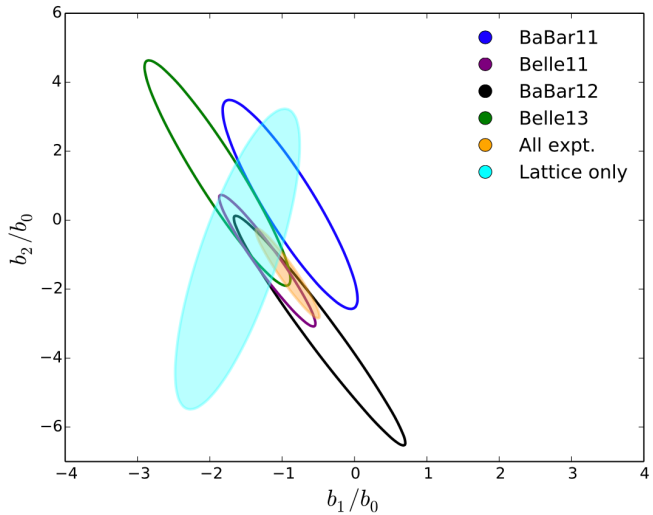
Topics (see also the previous talks by Aida El-Khadra and Aoife Bharucha)

- $B \to \pi \ell \nu_\ell$ ($\ell = e, \mu$): the shape (slope,curvature,...) of $f_{B\pi}^+(q^2)$
  - both calculable and measurable: a test of QCD method
- $B \to \pi \ell \nu_\ell$: normalization of $f_{B\pi}^+(q^2)$ - only calculable
- $B \to \pi \tau \nu_\tau$, R_π shape of $f_{B\pi}^0(q^2)$
- $B_s \to K$ for V_{ub}, the ratio $f_{B_sK}(q^2)/f_{B\pi}(q^2)$, test of QCD method
- $B \to K^{(*)} \ell^+ \ell^-$ - the problem of nonlocal effects prevails
- $\Lambda_b \to p \ell \nu_\ell$, $\Lambda_b \to \Lambda \ell^+ \ell^-$, *lattice: [Detmold, Lehner, Meinel, 1503.01421]*
  LCSRs:[AK,C.Klein,T.Mannel,Y.M.Wang,1108.2971];[T.Feldmann,M.Yip,1111.1844]
- $B \to \pi \pi \ell \nu_\ell$ including ρ and beyond
  LCSRs B-DAs: [S.Cheng, AK, J.Virto, 1701.01633]
- $B \to K \pi \ell \nu_\ell$, K^* and beyond, including $J^P = O^+$ states
  LCSRs with B-DAs: [S. Descotes-Genon, AK, J.Virto, K.Vos work in progress]
- $B \to p \bar{p} \ell \nu_\ell$ is a challenge, maybe LCSRs with $\bar{p}p$-distribution amplitudes?
  (similar to $B \to \pi \pi \ell \nu_\ell$ with 2π DAs in *[C.Hambrock, AK, 1511.02509]*)
- $B \to \gamma \ell \nu_\ell$, crucial source of info on B-meson DA
- $B_c \to D \ell \nu_\ell$, is there a theory method?

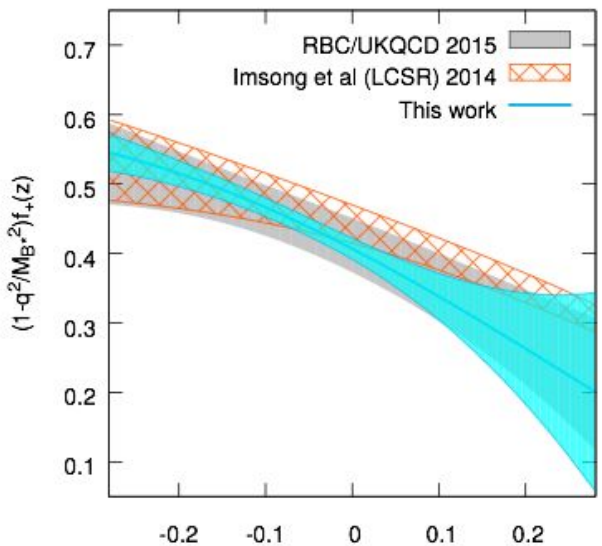
Backup slides

$B \to \pi \ell \nu_\ell$ from Fermilab-MILC 1503.07839 [hep-lat]

- slope of $f_{B\pi}^{+}(q^2)$



- normalization of $f_{B\pi}^{+}(q^2)$



$B_s \to K$, $B \to K$ LCSR, vs lattice at large recoil (from [AK, A.Rusov,1703.04765])

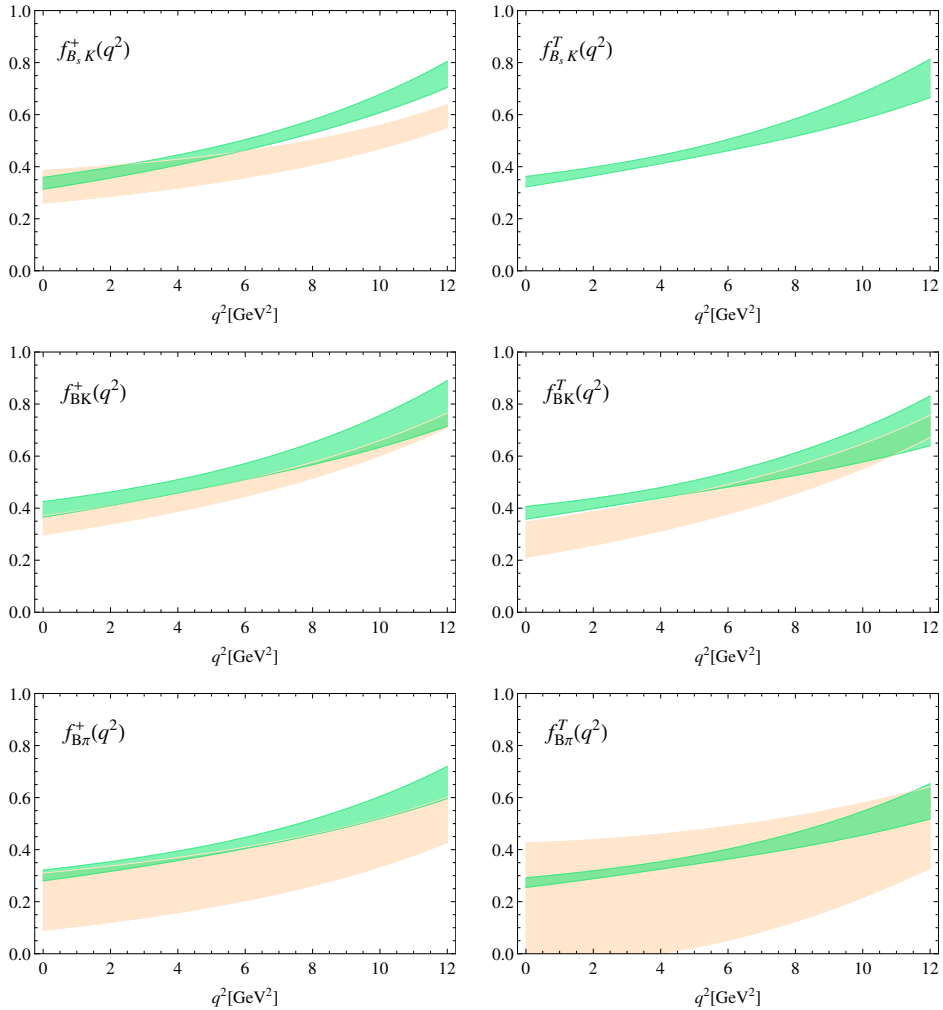


Figure 1. The vector (tensor) form factors of $B_s \to K$, $B \to K$ and $B \to \pi$ transitions calculated from LCSRs including estimated parametrical uncertainties are shown on the upper, middle and lower left (right) panels, respectively, with the dark-shaded (green) bands. Extrapolations of the lattice QCD results for $B_s \to K$ [Fermilab-MILC (2014)], $B \to K$ [HPQCD] and $B \to \pi$ [Fermilab=MILC (2015)] form factors are shown with the light-shaded (orange) bands.

$B \to \pi\pi$ form factors *from [S.Cheng, AK, J.Virto, 1701.01633]*