

MITP report “Challenges in semileptonic B decays”

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Why?

- A lot of interesting things came out in the talks/discussions which should be documented (for non-attendants, students, ...)
- Try to form a consensus within our community, points of disagreement should be spelled out
- Give a long term strategy for the field
- Reference (“form factor dictionary”)
- Make up for the aborted attempt of a report from the last workshop
- Nobody is forced to contribute, but also open to people who could not attend

Format

- Report of this one week workshop, not a review (no need to repeat work that has already been done)
- About 20-30 pages
- Outline – 4 chapters following the workshop format ($b \rightarrow c, u$ excl, incl), 5th chapter for purely leptonic
- We plan to submit it to a journal provided it is of high enough quality

Timeline

- By the summer 2018

Start: Apr-11 (Wed)

Draft 0: May 14 (Mon)

Draft 1: Jul 16 (Mon)

Done: Sep 15 (Sat)



Tentative outline

- Heavy to heavy exclusive (incl. FF dictionary)
 - Vera Luth, Concezio Bozzi, Christine Davies, Martin Jung, Stefan Schacht, Enrico Lunghi*, *Greg CIEZAREK** (interface exp/th), Zoltan Ligeti (D**), Weonjong Lee (proofreading)
- Heavy to light exclusive, $B \rightarrow l\nu\gamma$
 - Aida El-Khadra, Stefan Meinel, Alexander Khodjamirian*, Gil Paz, Aoife Bharucha, William Sutcliffe (Belle II), Marta Calvi (LHCb)
- Heavy to light inclusive
 - Gil Paz, Paolo Gambino*, Florian Bernlochner (tbc), Lu Cao, Marcello Rotondo, Vera Luth
- Heavy to heavy inclusive
 - Christoph Schwanda*, Thomas Mannel, Shoji Hashimoto
- Leptonic ($B \rightarrow l\nu$), quark masses
 - Andreas Kronfeld, Silvano Simula, Slavomira STEFKOVA

* = coordinator

Heavy to heavy exclusive

- Theory SM/NP
 - Parameterizations
 - NP in heavy to heavy
 - NP impact on coefficients (HAMMER)
- Experiments
 - Recap/perspectives for LHCb/Belle II
 - Auxiliary measurements (D decays, double charm)
- Recommendations for future calculations/analyses

Heavy to light exclusive

- General intro (FF, z expansion) – avoid duplication with heavy to heavy
- $B \rightarrow \pi, K$ lattice calculations (Aida), LCSR (Aoife)
- Baryons on lattice (Stefan)
- $B \rightarrow \pi \pi | \nu, K K | \nu$
- $B \rightarrow \pi \tau \nu (R_\pi)$
- $B \rightarrow l \nu \gamma$ (Florian)
- Every topic should also include an experimental contribution
- Issues/challenges

Heavy to light inclusive

- BLNP vs. GGOU, issue in the BaBar analysis to be described
- Higher order corrections (α_s /perturbative incomplete)
- Power corrections
- Can one use the endpoint in $b \rightarrow c$ inclusive?
- Utilizing spectra in better way (SIMBA, NNvub)
- Relation to $b \rightarrow s\gamma$

Heavy to heavy inclusive

- Overall ~5 pages
- Executive Summary
- CS: Experiment
- TM: Theory
- Challenges:
 - Experiment: Isospin, Lepton Flavour Universality, Tauonic decays, Tests of new Physics from the cut-dependence of the moments, Λ_b and B_c : Methodology
 - Theory: Higher orders in $1/m$, HQE parameter from lattice, TM + Simula: **Quark masses (in this chapter?)**, TM: Calculations of moments, Duality violations, OPE for B_c and Λ_b , QED Corrections: Role of Photos
- Outlook:
 - 50 ab-1: Sub percent precisions?
 - Systematics?

Leptonic

- Assess **experimental status and prospects** for leptonic decays
- Decay constants from lattice QCD
 - Improvements requires isospin/em
- Soft gamma
 - What has been done for K, how this can be expanded
- Quark masses (if not dealt with before)
- $B_{(s)} \rightarrow \mu \mu$
- $B \rightarrow \mu \mu \mu \nu$ (one § on how it might be addressed theoretically)

QED corrections/PHOTOS

- Issues/limitations should be pointed out in every section
- Spell out implicit assumptions on photon energies where PHOTOS is correct