# Journée de la saveur à IJCLab

vendredi 2 juin 2023 - vendredi 2 juin 2023

IJCLab

# Recueil des résumés

# Contents

**1**

# New physics search via CP observables in $B_s^0 \to \phi\phi$ decays with left- and right-handed Chromomagnetic operators (10'+3')

**Auteurs:** Emi Kou[1]; Tejhas Kapoor[2]

[1] *LAL*

[2] *IJC Lab*

**Auteurs correspondants:** tejhas.kapoor@ijclab.in2p3.fr, kou@lal.in2p3.fr

In this work, we investigate the time-dependent angular analysis of $B_s^0 \to \phi\phi$ decay to search for new physics signals via CP-violating observables. We work with a new physics Hamiltonian containing both left- and right-handed Chromomagnetic dipole operators. The hierarchy of the helicity amplitudes in this model gives us a new scheme of experimental search, which is different from the ones LHCb has used in its analysis. To illustrate this new scheme, we perform a sensitivity study using two pseudo datasets generated using LHCb's measured values. We find the sensitivity of CP-violating observables to be of the order of $5-7\%$ with the current LHCb statistics. Moreover, we show that Belle(II)'s $B_d^0 \to \phi K_s$ and LHCb's $B_s^0 \to \phi\phi$ measurements could be coupled within our model to obtain the chirality of the new physics.

**2**

# On QED corrections to $\bar{B} \to \bar{K}\ell^+\ell^-$ and $R_K$: Theory vs Experiment (15'+3')

**Auteur:** saad nabeebaccus[1]

[1] *IJCLab*

**Auteur correspondant** nabeebaccus@ijclab.in2p3.fr

In my talk, I will present our recent work in 2205.08635. Starting from the QED result at 1 loop for $\bar{B} \to \bar{K}\ell^+\ell^-$ derived in our earlier work (2009.00929), we build a dedicated Monte Carlo, which we use to cross-check PHOTOS. Next, we investigate the effect of charmonium resonances (in particular the $J/\psi$ one) on the 1-6 GeV$^2$ $q^2-$bin used to determine $R_K$. Importantly, still using our Monte Carlo, we analyse the interference effects between the rare and the resonant modes, which is assumed to be negligible in the LHCb experimental analysis. Finally, we obtain semi-analytical results for the full contribution (resonant+rare) of QED corrections in $\bar{B} \to \bar{K}\ell^+\ell^-$, by using a splitting function formalism which captures all large logarithms.

**3**

# Probing Lepton Flavor Violation in Meson Decays with LHC Data (10'+3')

**Auteur:** Ioannis Plakias[1]

[1] *IJCLab*

**Auteur correspondant** plakias@ijclab.in2p3.fr

In this letter, we use LHC data from the Drell-Yan processes $pp \to \ell_i\ell_j$ (with $i \neq j$) to derive model-independent upper limits on lepton-flavor-violating meson decays. Our analysis is based on

an Effective Field Theory (EFT) approach and it does not require a specific assumption regarding the basis of effective operators. We find that current LHC data (140 $\mathrm{fb}^{-1}$) already provides competitive limits on $\mathcal{B}(B \to \pi e\tau)$ and $\mathcal{B}(B \to \pi\mu\tau)$ with respect to the ones obtained through experimental searches at the $B$-factories. Moreover, we derive upper limits on several decays that have not been searched for experimentally yet, such as $D^0 \to e\tau$ in the charm sector, and various semileptonic decays such as $B \to \rho\mu\tau$, $B_s \to K\mu\tau$ and $B_s \to \phi\mu\tau$. Lastly, we discuss the validity of the EFT description of LHC data and the impact of loop corrections in our analysis.

**4**

## QCD effects in B decays (15'+3')

**Auteur:** Méril Reboud[1]

[1] *IPPP, Durham & IJClab, Orsay*

**Auteur correspondant** meril.reboud@durham.ac.uk

Hadronic uncertainties are the main blockers for a full phenomenological use of experimental B decays analyses. I will show that global analyses of the b -> s transitions based on analyticity and unitarity give the proper framework to systematically reduce these uncertainties.

**5**

## Angular analysis of the decay $\Lambda_b^0 \to \Lambda\ell^+\ell^-$ at high $q^2$ with the LHCb experiment (10'+3')

**Auteurs:** Janina Nicolini[1]; Marie-Hélène Schune[2]

[1] *IJCLab / TU Dortmund*

[2] *IJCLab*

**Auteurs correspondants:** marie-helene.schune@ijclab.in2p3.fr, janina.nicolini@ijclab.in2p3.fr

To improve the understanding of the differences observed in several different observables of mesonic $b \to s\ell^+\ell^-$ transitions, it is important to also study $b \to s\ell^+\ell^-$ transitions in baryon decays.
The decay $\Lambda_b^0 \to \Lambda\ell^+\ell^-$ is particular interesting due to the fact that it is the most abundant produced weakly decaying b-baryon. Studying the angular distribution of both the muon and electron decay of $\Lambda_b^0 \to \Lambda\ell^+\ell^-$ allows to precisely test the Standard Model of particle physics and provide a novel test of lepton flavour universality with the angular coefficients.
In my talk I will cover the current status of the angular analysis and the prospects of the test of lepton flavour universality with the angular coefficients.

**6**

## Towards a measurement of $R_{K^*}$ at high-$q^2$ (15'+3')

**Auteur:** Guillaume Pietrzyk[1]

[1] *IJCLab*

**Auteur correspondant** guillaume.pietrzyk@ijclab.in2p3.fr

In December 2022, LHCb released a new test a lepton flavor universality through the simultaneous measurement of $R_K$ and $R_{K^*}$ in two intervals of the dilepton invariant mass: $q^2 \in [0.1, 1.1]\,\text{GeV}^2$ (low-$q^2$) and $q^2 \in [1.1, 6.0]\,\text{GeV}^2$ (central-$q^2$). This talk presents the analysis of a measurement of $R_{K^*}$ in a region of high values of $q^2$, located above the $J/\psi$ and $\psi(2S)$ resonances and never performed by LHCb. In particular, this challenging measurement demands a high control of the pollution of $\psi(2S)$ contributions.

**7**

## New physics from oscillations at the DUNE near detector, and the role of systematic uncertainties (15'+3')

**Auteur:** Salvador Rosauro[None]

**Auteur correspondant** rosauro@ijclab.in2p3.fr

We study the capabilities of the future DUNE experiment to probe several new physics scenarios, namely deviations from unitarity of the leptonic mixing matrix, searches for light sterile states and NSI's. We study in detail the impact of several systematic uncertainties to the near detector sensitivity to new physics.

**8**

## Closing talk, "Radiative leptonic decays of pseudoscalar mesons from lattice QCD"

**Auteur correspondant** giuseppe.gagliardi@roma3.infn.it

**9**

## Angular analysis of the Bs->Phiee decay in the very-low $q^2$ bin to access photon polarization (10'+3')

**Auteur correspondant** gaelle.khreich@cern.ch