# New Perspectives for Testing Electron-Muon Universality

Anders Rehult


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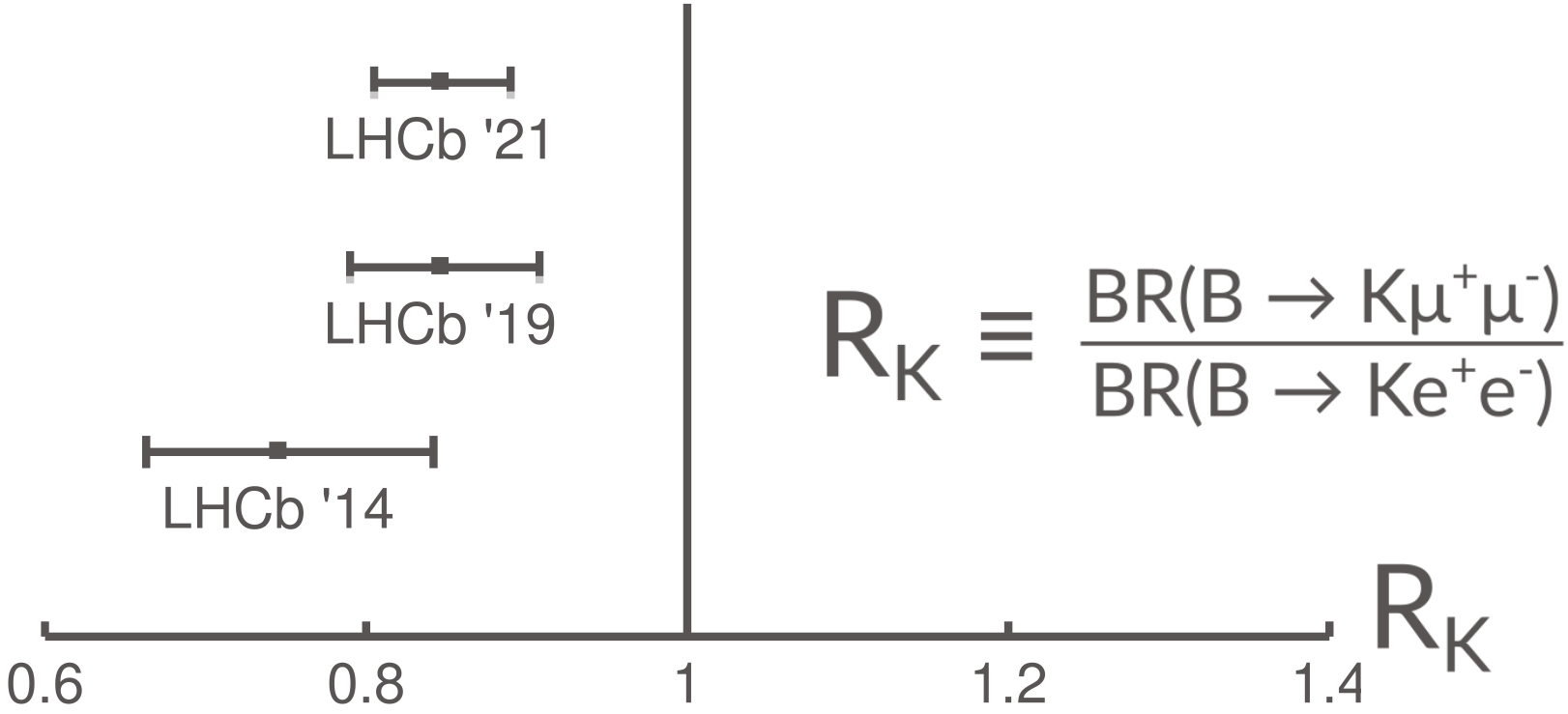
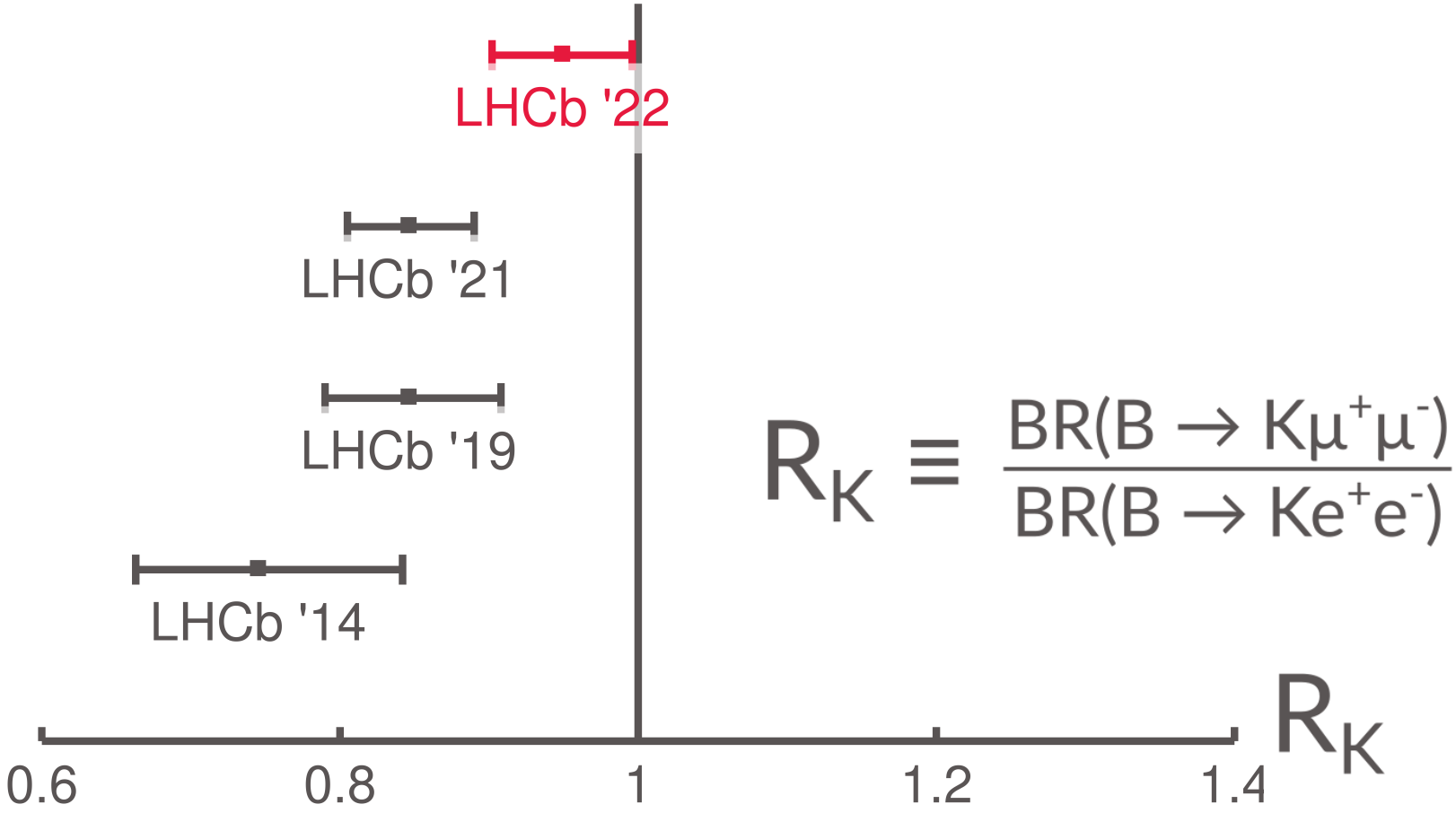
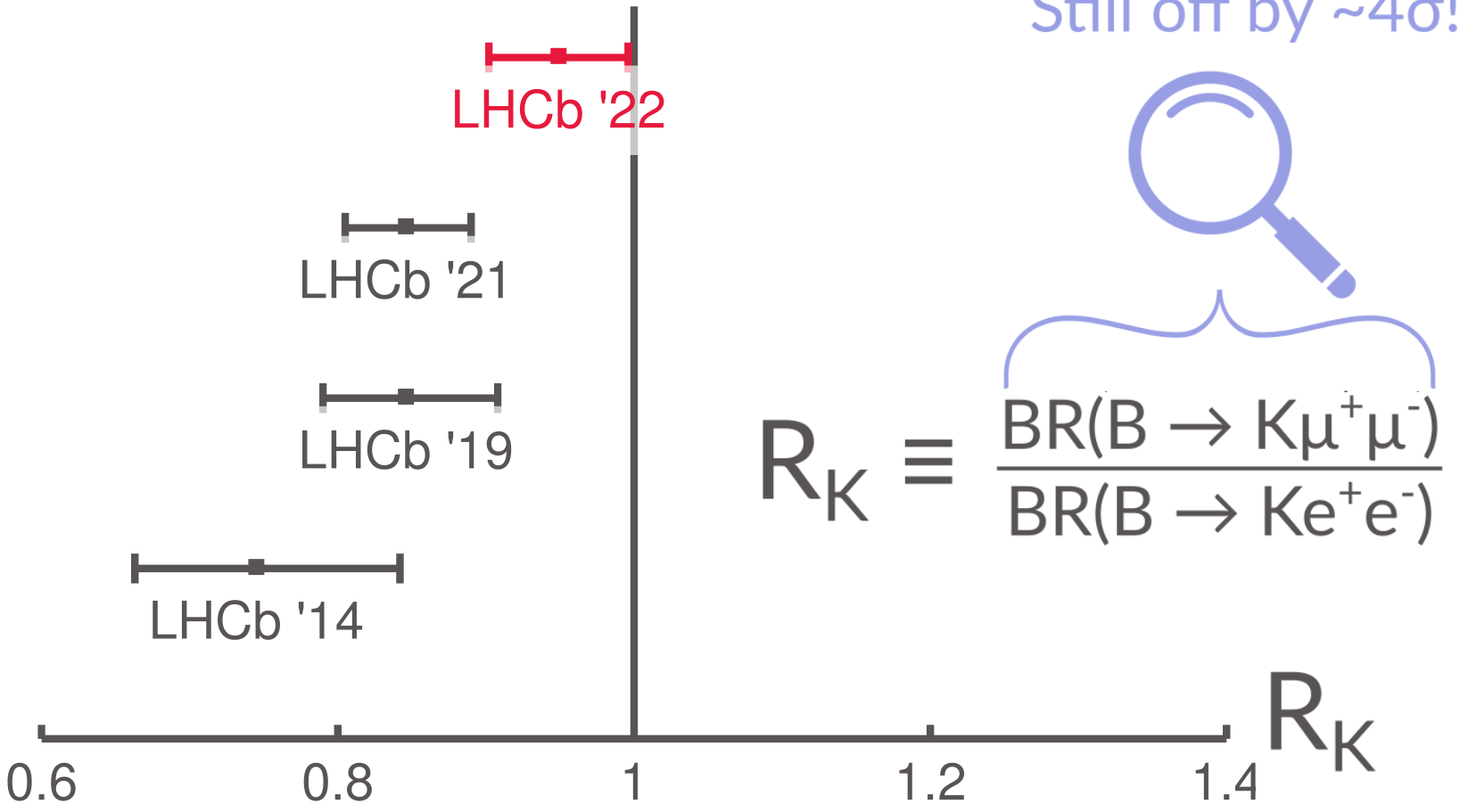

LHCb '21
LHCb '19
LHCb '14
$R_K \equiv \frac{BR(B \to K\mu^+\mu^-)}{BR(B \to Ke^+e^-)}$
0.6
0.8
1
1.2
1.4
$R_K$


LHCb '22
LHCb '21
LHCb '19
LHCb '14
$R_K \equiv \frac{BR(B \to K\mu^+\mu^-)}{BR(B \to Ke^+e^-)}$
0.6
0.8
1
1.2
1.4
$R_K$




Still off by ~4σ!

$$R_K \equiv \frac{BR(B \to K\mu^+\mu^-)}{BR(B \to Ke^+e^-)}$$

$C_{9\mu}$ $C_{9e}$

$$C_{9\mu} \overset{R_K}{\approx} C_{9e}$$

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$$C_9 \in \mathbb{R}$$

$$C_9 \in \mathbb{C}\,?$$

$C_9 \in \mathbb{C} \rightarrow$ CP violation

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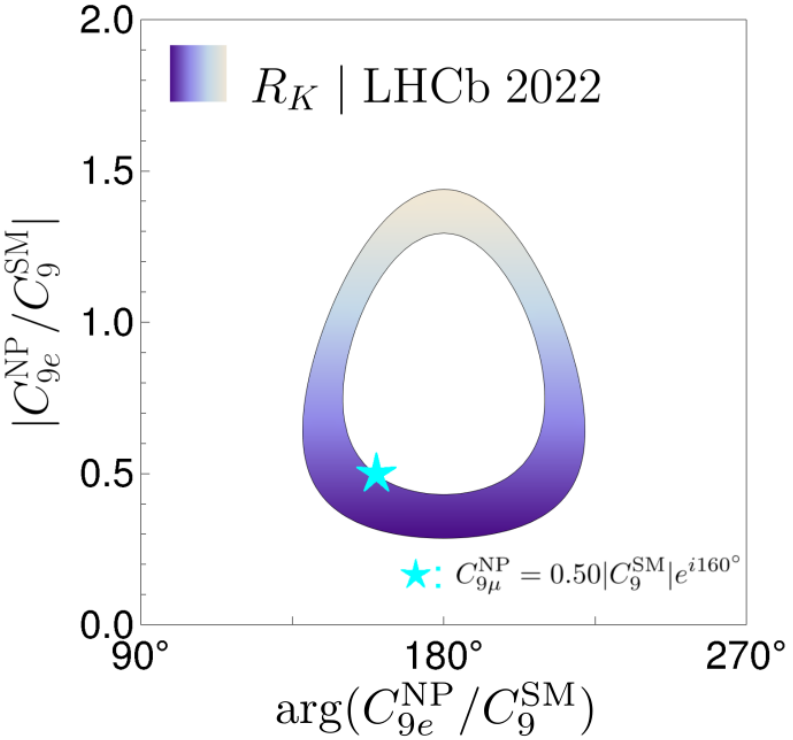
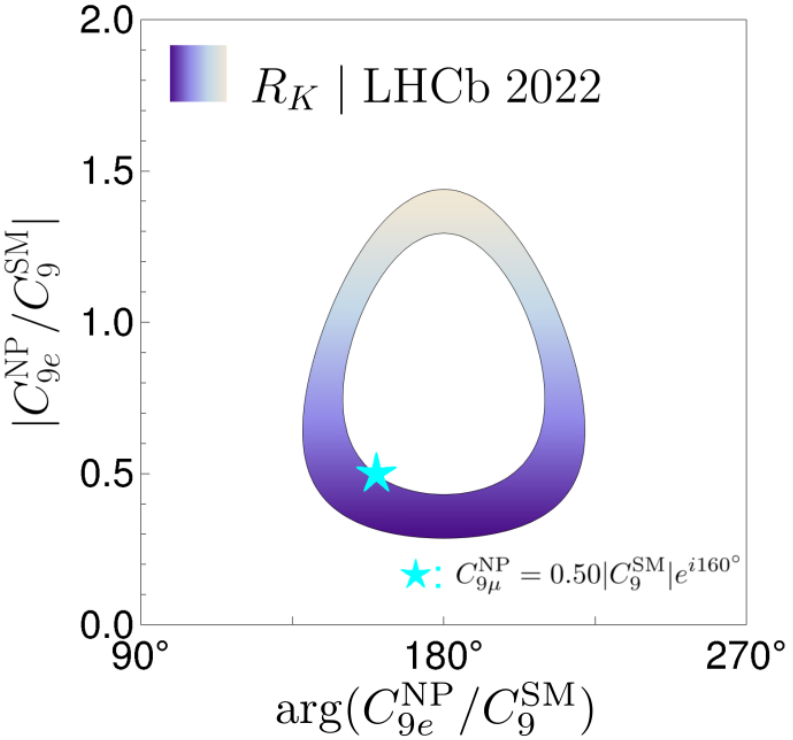
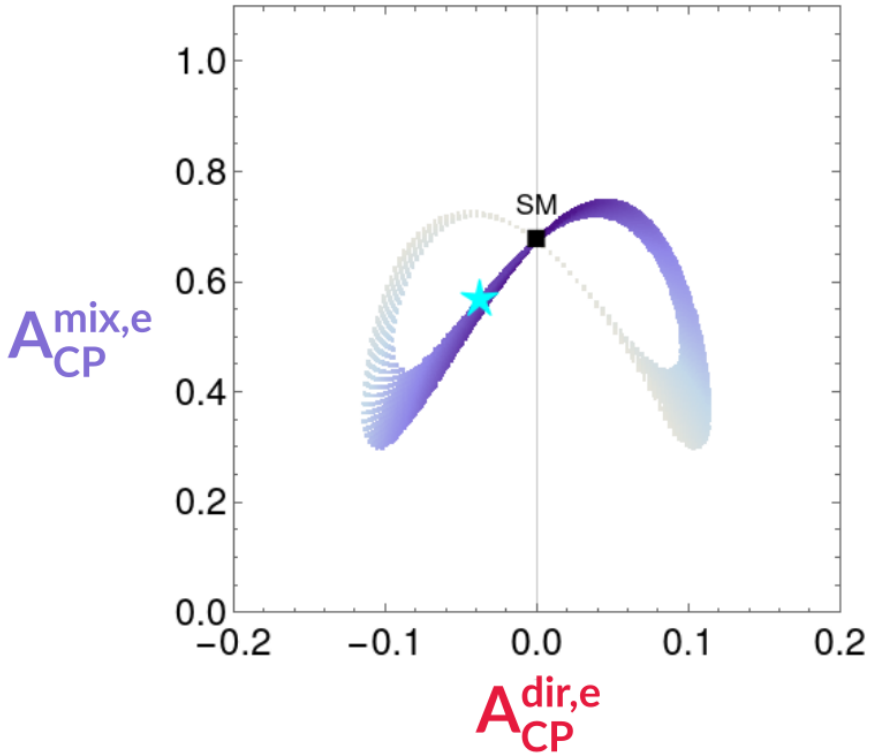
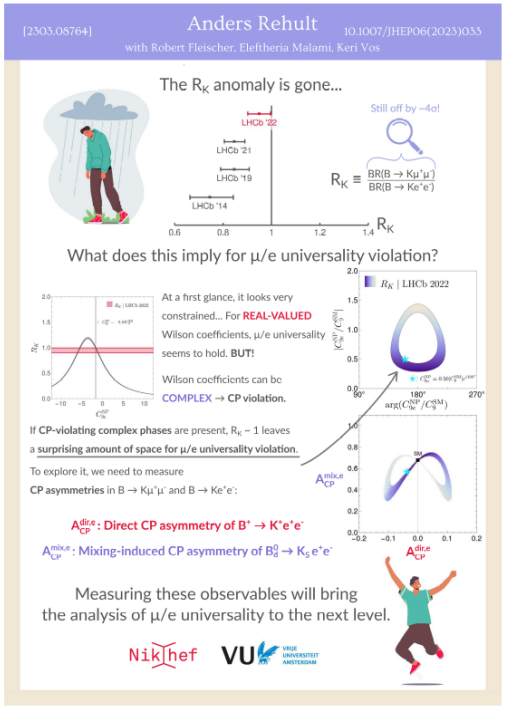


# $C_9 \in \mathbb{C} \rightarrow$ CP violation






# Thank you!

Music plug:



JHEP
Published for SISSA by Springer
Received: March 22, 2023
Accepted: May 24, 2023
Published: June 7, 2023

## New perspectives for testing electron-muon universality

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Abstract: Intriguing results for tests of the universality of electrons and muons through measurements of rates of $B \to K\ell^+\ell^-$ and similar decays have been in the spotlight for years. The LHCb collaboration has recently reported new results which are in agreement with Lepton Flavour Universality, while the individual decay rates are found below their Standard Model predictions. In view of this new situation, we explore how much space is left for a violation of electron-muon universality. Considering new sources of CP violation and taking the new LHCb measurements into account, we show that significant differences between the short-distance coefficients for electronic and muonic final states are actually allowed by the current data. These patterns can be revealed through CP asymmetries in neutral and charged $B \to K\ell^+\ell^-$ decays. We obtain correlations between these observables and map them to the short-distance coefficients. This results in regions in New Physics parameter space with large differences between CP asymmetries of the decays with final-state electrons and muons, thereby leaving a lot of room for possible surprises in the future high-precision era.

Keywords: Bottom Quarks, CP Violation, Rare Decays

ArXiv ePrint: 2303.08764



https://doi.org/10.1007/JHEP06(2023)033

JHEP06(2023)033

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