

New Perspectives for Testing Electron-Muon Universality

Anders Rehult



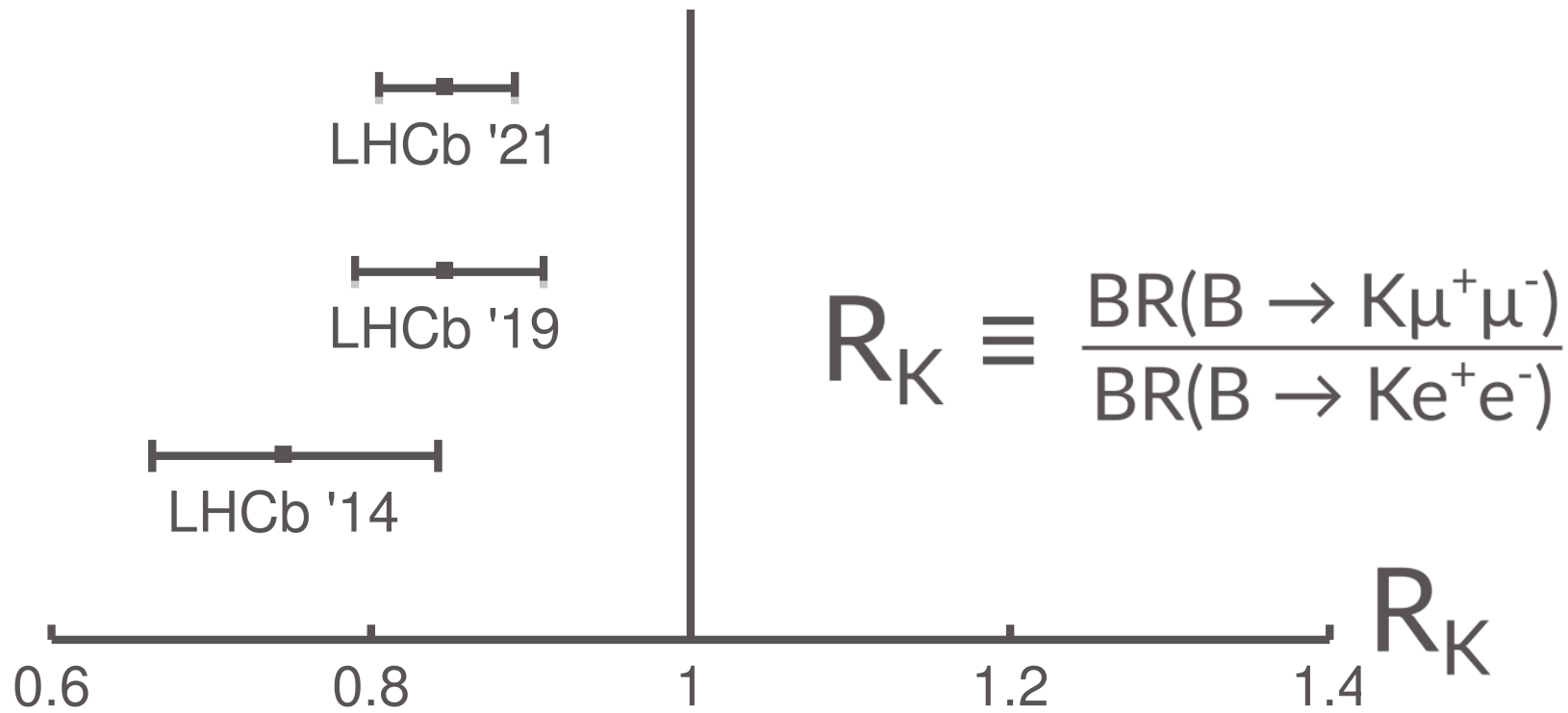


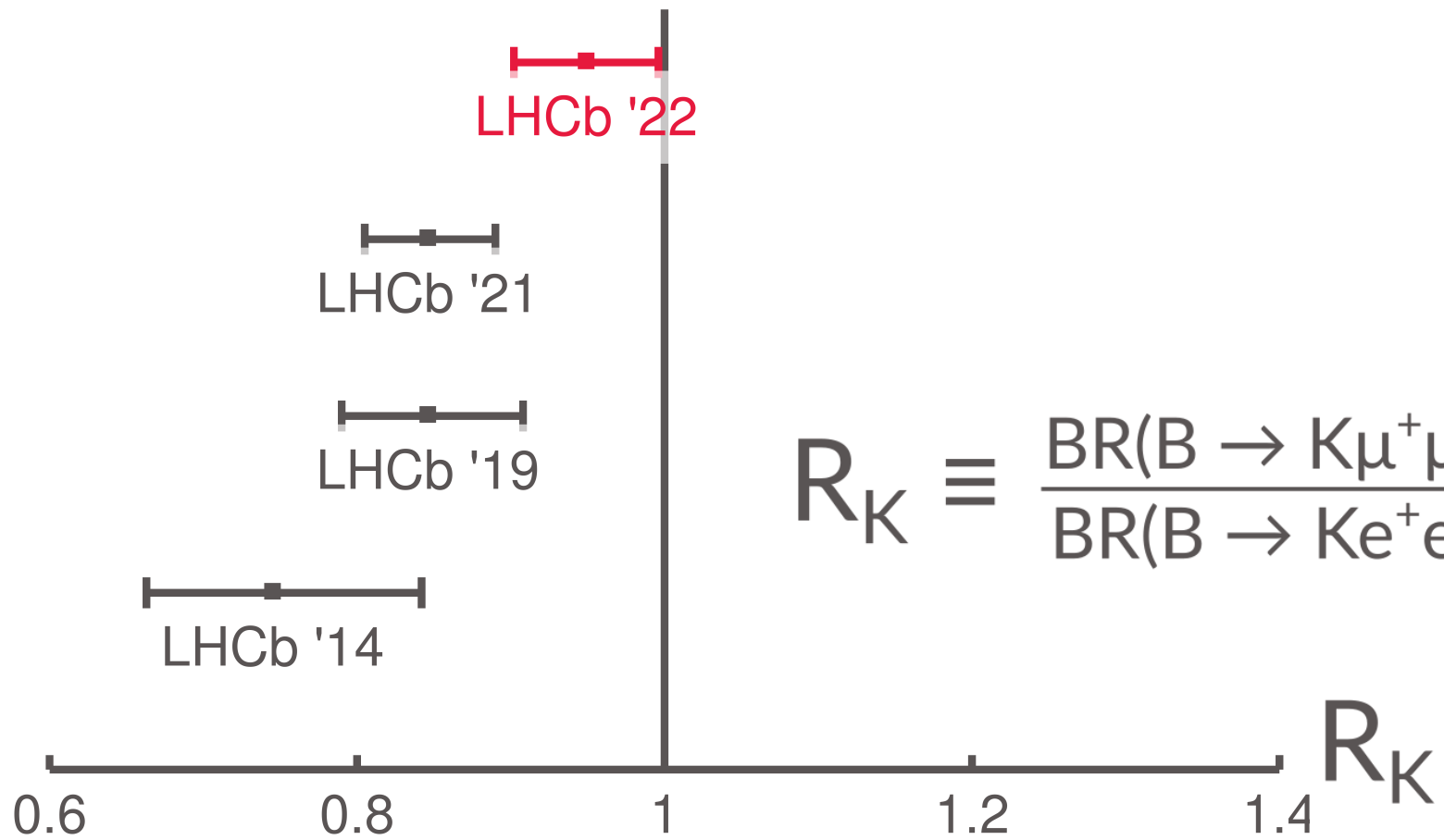




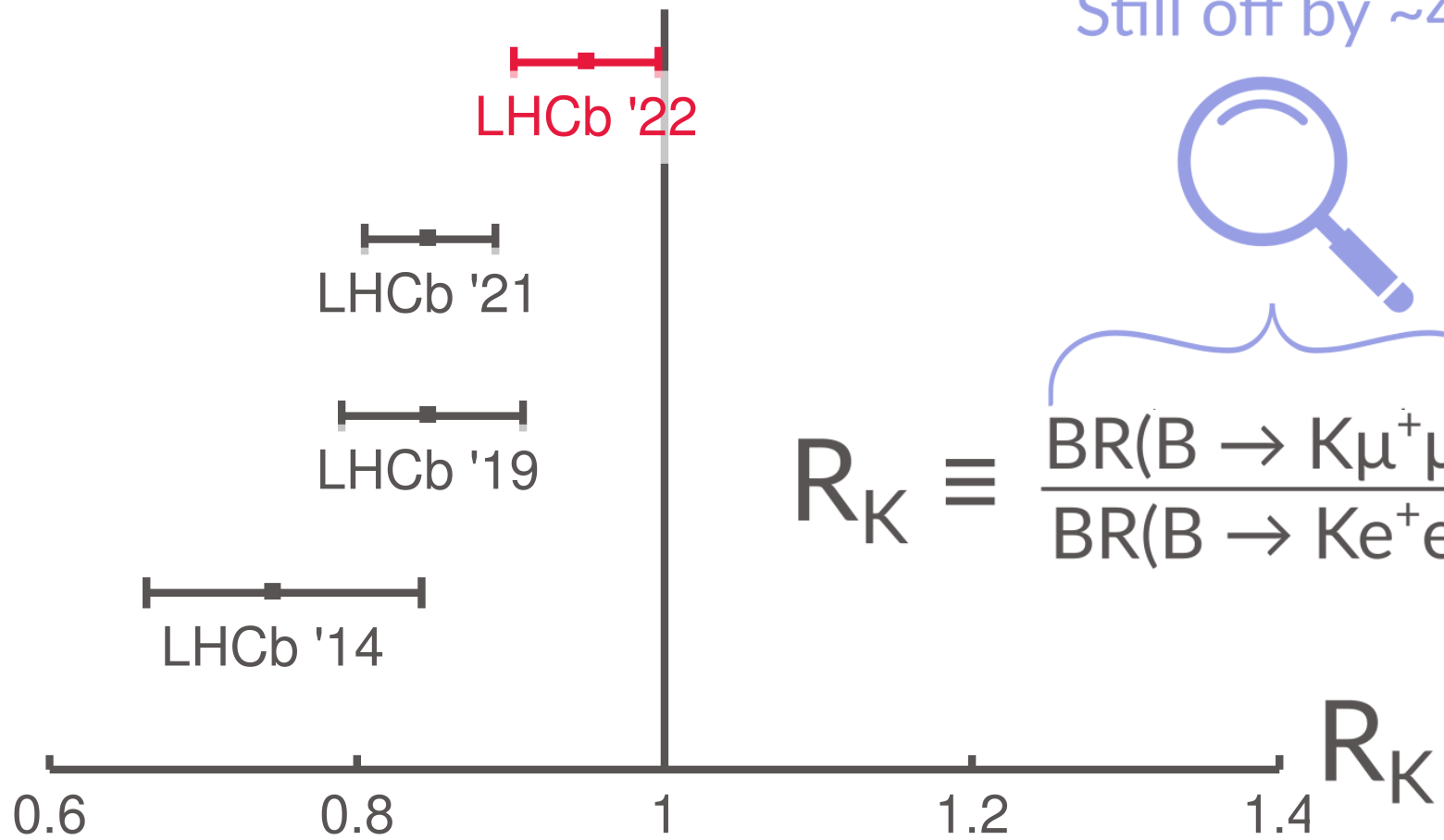
?







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



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$C_{9\mu}$

C_{9e}

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

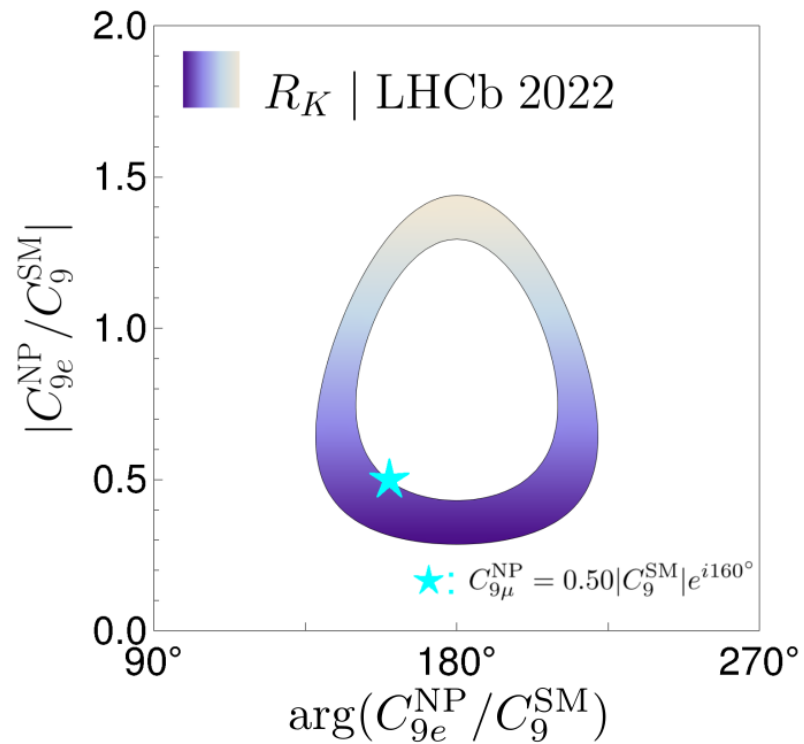
$$C_{9\mu} \stackrel{R_K}{\approx} C_{9e}$$

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

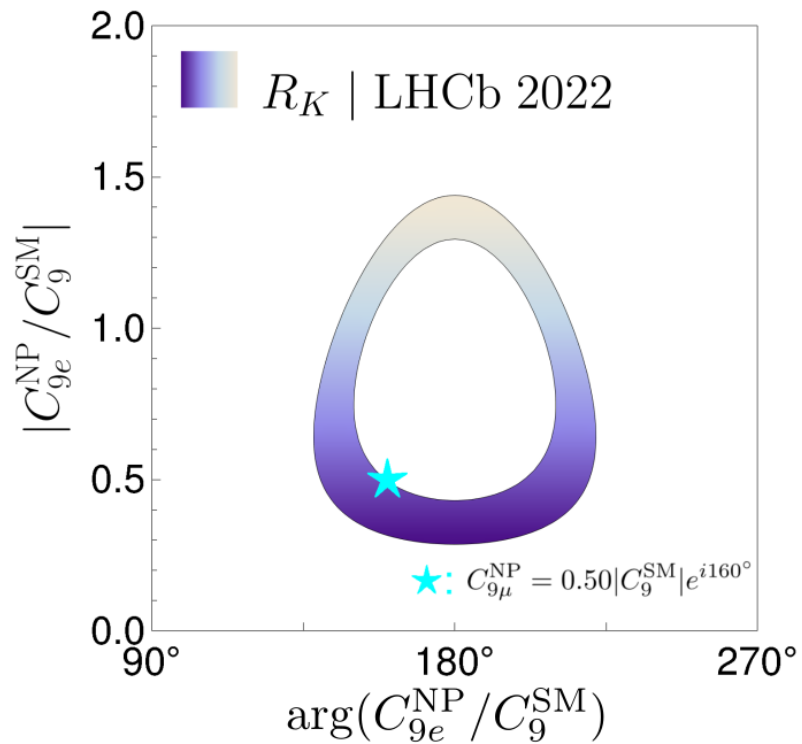
$$C_9 \in \mathbb{C} ?$$

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

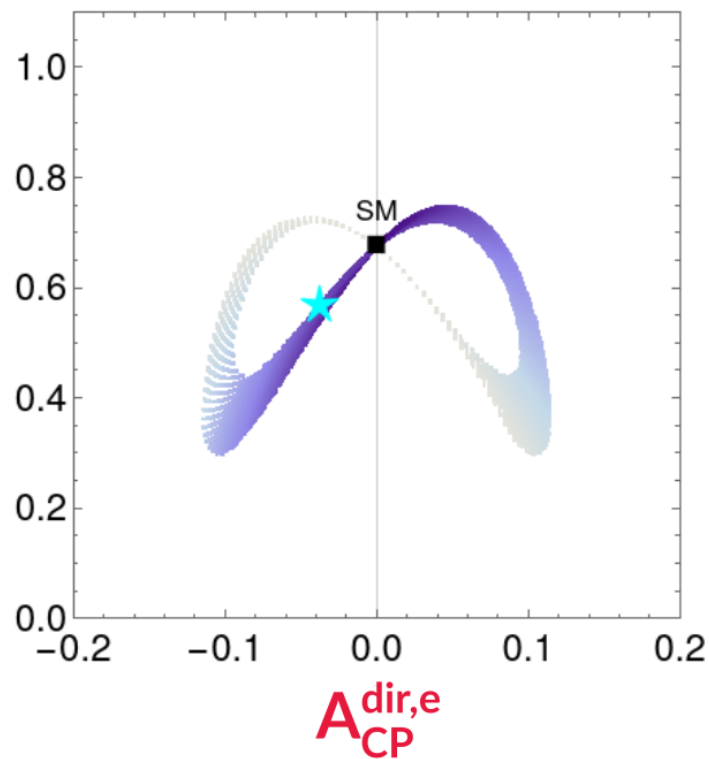
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$C_9 \in \mathbb{C} \rightarrow$ CP violation



$A_{CP}^{\text{mix},e}$



[2303.08764] Anders Rehult ID.1007/JHEP06(2023)033
with Robert Fleischer, Eleftheria Malami, Keri Vos

The R_K anomaly is gone...

Still off by -4!

$R_K \equiv \frac{BR(B \rightarrow K_\mu^+ \mu^-)}{BR(B \rightarrow K_e^+ e^-)}$

What does this imply for μ/e universality violation?

At a first glance, it looks very constrained... For **REAL-VALUED** Wilson coefficients, μ/e universality seems to hold. **BUT!** Wilson coefficients can be **COMPLEX** \rightarrow CP violation.

If CP-violating complex phases are present, $R_K \sim 1$ leaves a surprising amount of space for μ/e universality violation.

To explore it, we need to measure CP asymmetries in $B \rightarrow K_\mu^+ \mu^-$ and $B \rightarrow K_e^+ e^-$:

$A_{CP}^{dir,e}$: Direct CP asymmetry of $B^+ \rightarrow K^+ e^+ e^-$
 $A_{CP}^{mix,e}$: Mixing-induced CP asymmetry of $B_s^0 \rightarrow K_s^+ e^+ e^-$

Measuring these observables will bring the analysis of μ/e universality to the next level.

Nikhef VU UNIVERSITY AMSTERDAM

Thank you!

Music plug:



PUBLISHED FOR SISSA BY SPRINGER

RECEIVED: March 22, 2023
ACCEPTED: May 24, 2023
PUBLISHED: June 7, 2023

New perspectives for testing electron-muon universality

Robert Fleischer,^{a,b} Eleftheria Malami,^{a,c} Anders Rehult^{a,b} and K. Keri Vos^{a,d}

^aNikhef,

Science Park 105, NL-1098 XG Amsterdam, Netherlands

^bDepartment of Physics and Astronomy, Vrije Universiteit Amsterdam, NL-1081 HV Amsterdam, Netherlands

^cCenter for Particle Physics Siegen (CPPS), Theoretische Physik 1, Universität Siegen, D-57068 Siegen, Germany

^dGravitational Waves and Fundamental Physics (GWFP), Maastricht University, Duboisdomein 30, NL-6229 GT Maastricht, The Netherlands

E-mail: robert.fleischer@nikhef.nl, emalami@nikhef.nl, a.rehult@nikhef.nl, Keri.vos@nikhef.nl

ABSTRACT: Intriguing results for tests of the universality of electrons and muons through measurements of rates of $B \rightarrow K^l l^+ l^-$ 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 $B \rightarrow K^l l^+ l^-$ 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

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Article funded by SCOAP³.

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

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