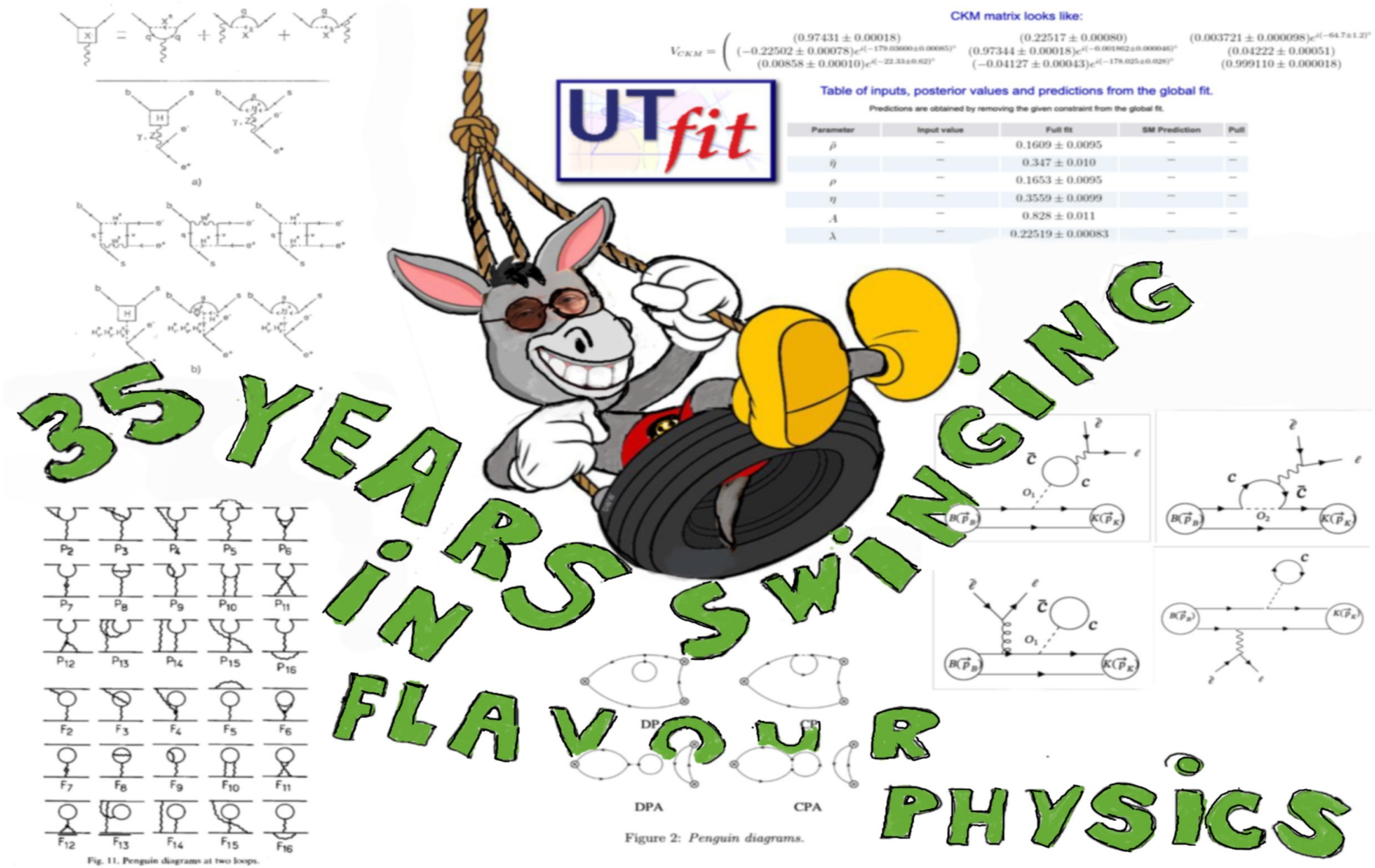


FROM b -> s ll TRANSITIONS TO NON-LEPTONIC DECAYS AND BACK

In the occasion of the Marco 60th birthday

PENGUINS IN TUTTE LE SALSE (ALL POSSIBLE WAYS):

A semi-serious talk on my long, fruitful and pleasant collaboration with Marco + Some recent developments in Flavor physics

Roma
17/05/2024

HOW ALL BEGAN

- *Nato a Roma il 30/04/1964*
- *Laurea con lode alla Sapienza 1988*
- *Ricercatore Sezione Sanità 1992*

we started working together

- *Dottorato in Fisica 1993*
- *Etc. Etc.*

La tesi di Marco, un destino segnato: diagrammi a pinguino e b -> s l^+ l^-

EFFETTI FENOMENOLOGICI DELLO SCAMBIO VIRTUALE

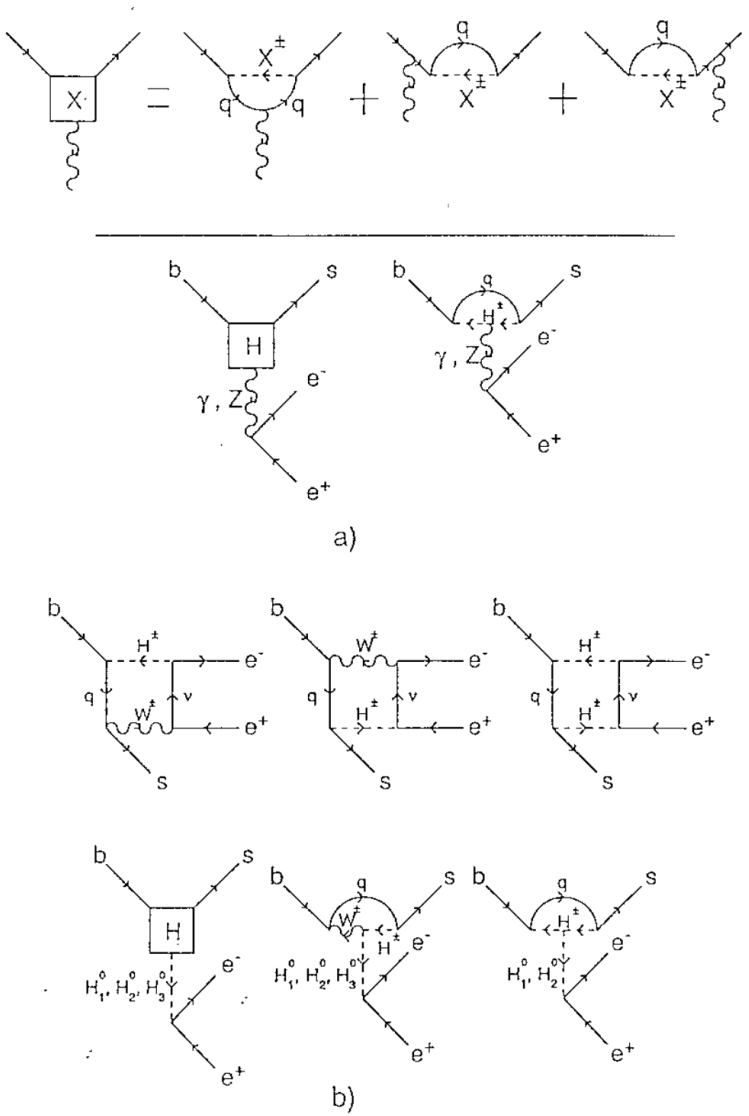
DI BOSONI DI HIGGS CARICHI

Laureando:

Marco Ciuchini
matr. N52494

Relatore:

Prof. Guido Altarelli



Effetti fenomenologici dello scambio virtuale di Bosoni di Higgs Carichi #1

Marco Ciuchini (Rome U.) (1988)

pdf cite claim reference search 0 citations

Effects of the Charged Higgs Boson on the $b \to s\ell^+\ell^-$ Decay #2

Marco Ciuchini (Rome, ISS) (Aug 1, 1989)

Published in: *Mod.Phys.Lett.A* 4 (1989) 1945

pdf DOI cite claim reference search 14 citations

QUARK - ANTI-QUARK PAIR PRODUCTION VIA gamma W FUSION AT HIGH-ENERGY e+ e- COLLIDERS #3

Marco Ciuchini (Rome, ISS), E. Franco (INFN, Rome), E. Gabrielli (Rome U. and INFN, Rome) (Oct, 1989)

Published in: *Z.Phys.C* 47 (1990) 577-582

DOI cite claim reference search 1 citation

Leading nonlogarithmic contribution to the electropenguin diagram and phenomenology of kaon decays #4

Marco Ciuchini (INFN, Rome and Rome, ISS), E. Franco (INFN, Rome), R. Onofrio (Rome U. and INFN, Rome) (Jun, 1990)

Published in: *Mod.Phys.Lett.A* 5 (1990) 2173-2181

pdf DOI cite claim reference search 2 citations

il primo contatto

B tagging with neural networks: An alternative use of single particle information for discriminating jet events #5

P. Branchini (INFN, Rome and Rome U.), Marco Ciuchini (INFN, Rome and Rome U.), P. Del Giudice (INFN, Rome and Rome U.) (1992)

Contribution to: AIHENP 92, 435-442

cite claim reference search 0 citations

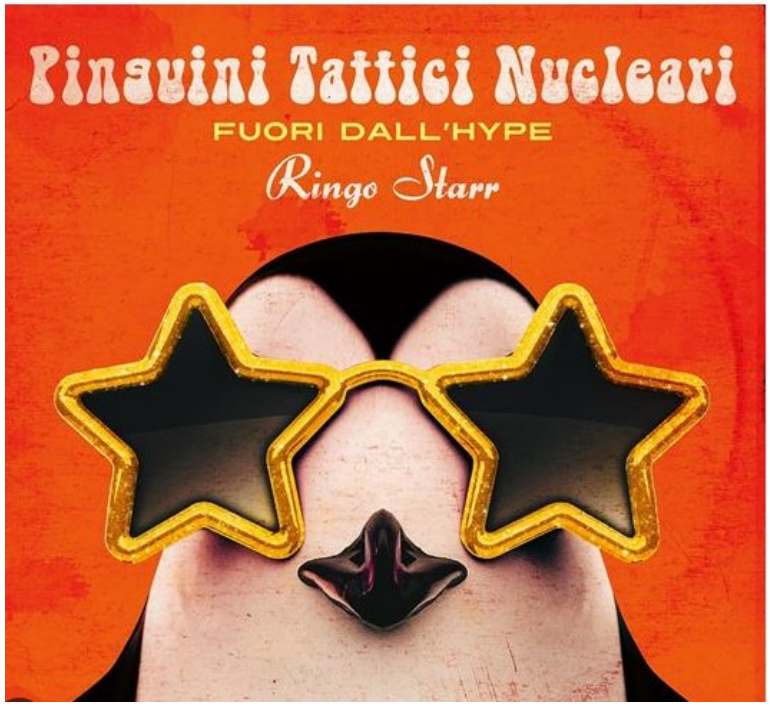
B Tagging with neural networks : An Alternative Use of Single Particle Information for Discriminating Jet Events #6

P. Branchini, M. Ciuchini, P. Del Giudice (Feb 25, 1992)

cite claim reference search 0 citations

Preprint n.745
June 13, 1990

Dipartimento di Fisica
Università di Roma "La Sapienza"
I.N.F.N. - Sezione di Roma

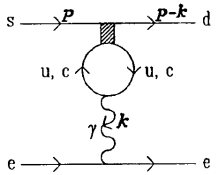


M.Ciuchini, E.Franco, R.Onofrio

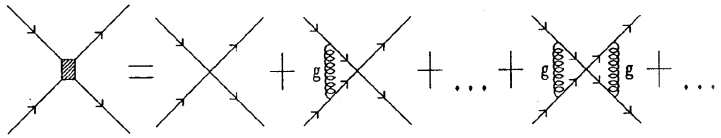
LEADING NON-LOGARITHMIC CONTRIBUTION TO THE ELECTROPENGUIN DIAGRAM AND PHENOMENOLOGY OF KAON DECAYS

Acknowledgments

We are grateful to G. Martinelli for eliciting our interest in this topic and for useful discussions and to G. Altarelli for a critical reading of the manuscript.



(a)



(b)

Where all started

(Ringberg Castle, 1988)

Guido and Andrzej Buras discussed the need of an NLO determination of the $\Delta S=1$ effective Hamiltonian for the $\Delta I=1/2$ rule, ε'/ε, etc.

Both resolved to start the enterprise

← **the competitor**

Andrzej founded the Munich NLO club with Peter Weisz

the whole story in 1102.5650 (106 pages)

From Marco Ciuchini slides

My recollection:

1) Andrzej discussed with me
charm mass effects and NLO corrections
at the CERN canteen
2) At that time only one calculation
of NLO corrections to the
Weak Hamiltonian existed

G. Altarelli,G. Curci, G. Martinelli and S. Petrarca
Nucl. Phys. B187 (1981) 461-513 (DRED)

LO by M.K. Gaillard and B.W. Lee, Phys. Rev. Lett. 33 (1974) 108
G. Altarelli and L. Maiani, Phys. Lett. B52 (1974) 351

Current-Current Diagrams in DRED

The birth of the
ε – operators
``effervescent''
evanescent

G. Altarelli, G. Curci, G. Martinelli and S. Petrarca

Buras & Weisz showed that NDR could be used as well

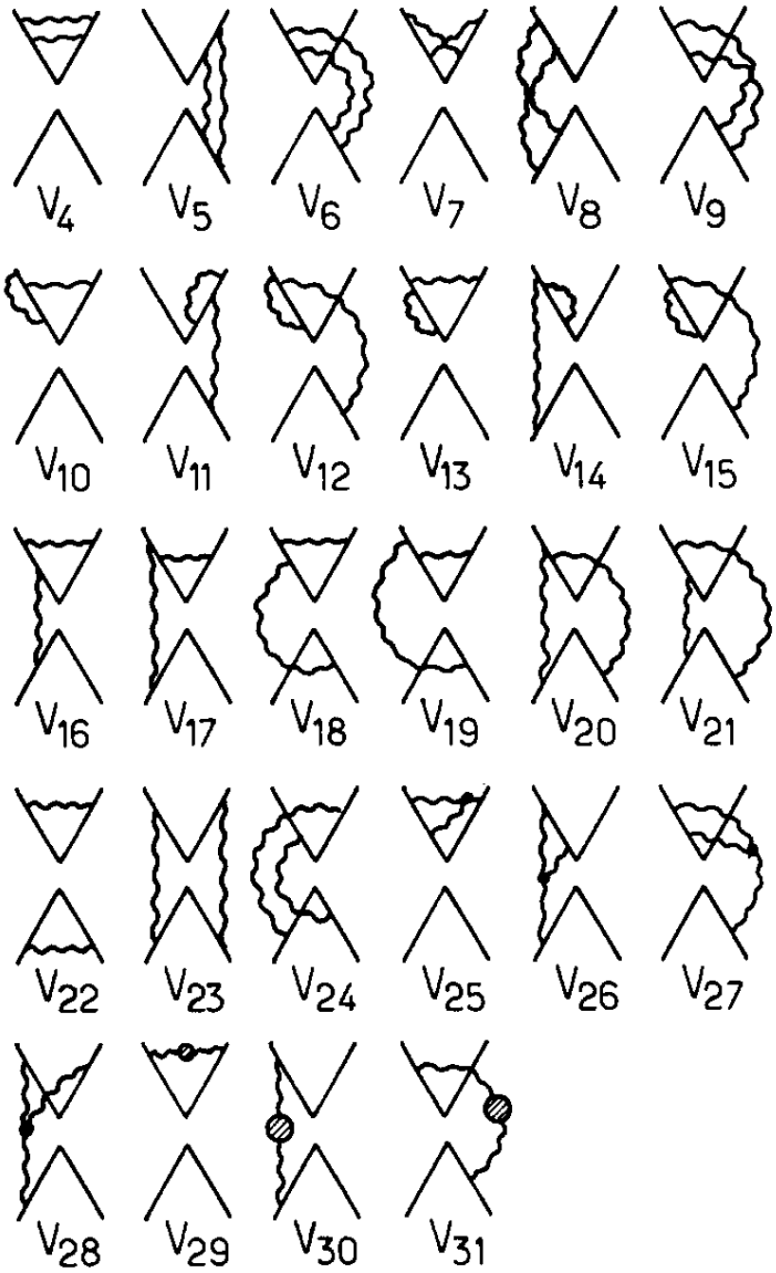
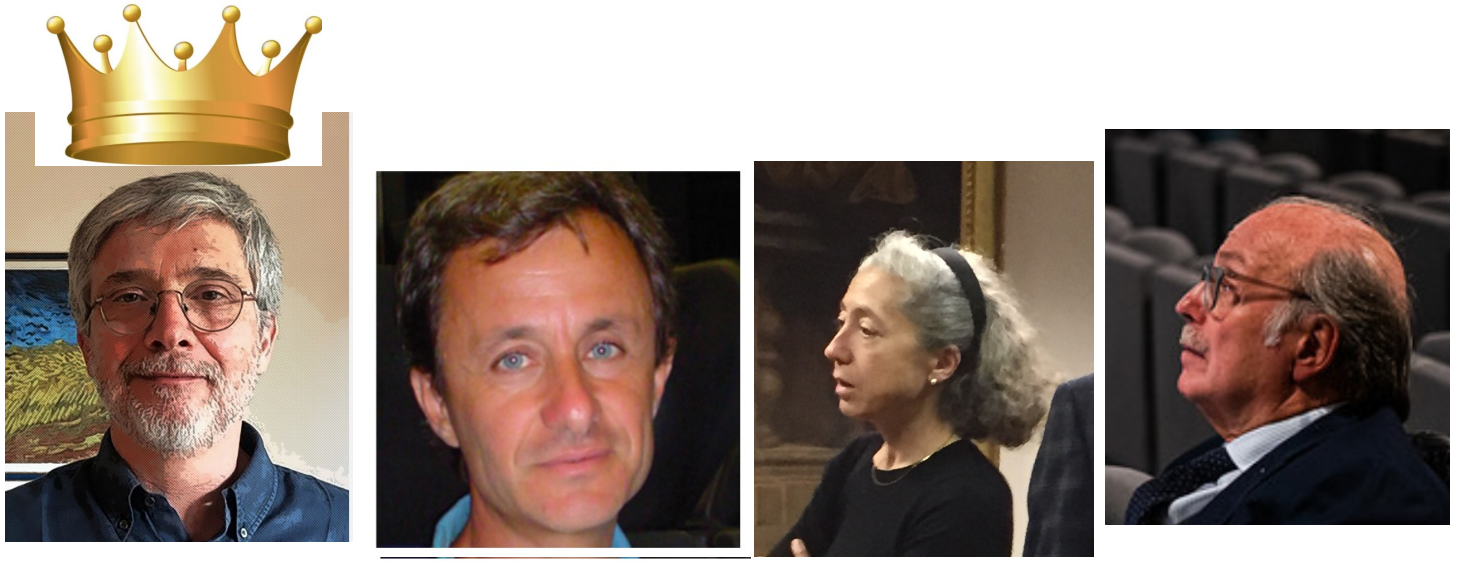


Fig. 10. Current–current diagrams at two loops.

The Italian Team



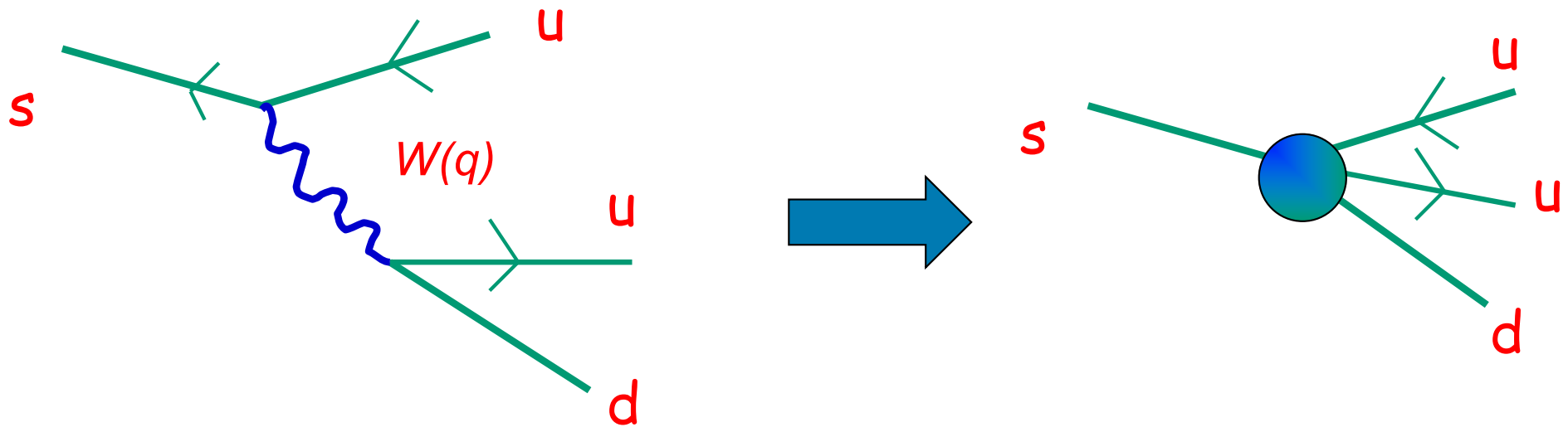
- 3 giovani brillanti + un veterano del NLO per battere Buras sul tempo

- 2 dottorandi: Laura e Marco

α_s α_{em}

Complete calculation of the NLO corrections to the effective Hamiltonian $\Delta F = 1$

The Effective Hamiltonian, Wilson OPE and QCD Corrections



$$q \sim m_K \ll M_W$$

$$\mathcal{H}_{eff} = -\frac{G_F}{\sqrt{2}} V_{ud} V_{us}^* \left(\bar{s}\gamma_\mu(1-\gamma_5)u\right)\left(\bar{u}\gamma^\mu(1-\gamma_5)d\right)$$

GENERAL FRAMEWORK: THE OPE

$$A_{FI}\,(2\pi^4)\,\delta^4\,(p_F - p_I) = \int d^4x\, d^4y\, D_{\mu\nu}\,(x, M_W)$$

$$\langle F\,|T[\,J_\mu\,(y+x/2)\,J^\dagger_\nu\,(y-x/2)]\,|\,I\,\rangle$$

$$\langle F\,|\,H^{\Delta S=1}\,|\,I\,\rangle =$$

$$G_F/\sqrt{2}\;V_{ud}\;V_{us}^{*} \qquad \Sigma_i\, C_i\,(\mu)\,\langle F\,|\,Q_i\,(\mu)\,|\,I\,\rangle \;\Big/\; (M_W)^{\,di-6}$$

di= dimension of the operator $Q_i\,(\mu)$

$C_i\,(\mu)$ Wilson coefficient: it depends on M_W/μ and $\alpha_W\,(\mu)$

$Q_i\,(\mu)$ local operator renormalized at the scale μ

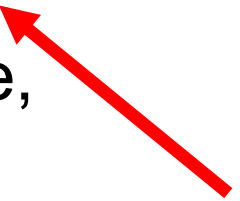
GENERAL FRAMEWORK

$$H^{\Delta S=1} = G_F/\sqrt{2}\, V_{ud}\, V_{us}^{*}\Big[(1-\tau) \sum_{i=1,2} z_i (Q_i - Q^c_i) + \tau \sum_{i=1,10} (z_i + y_i)\, Q_i \Big]$$

Where y_i and z_i are short distance coefficients, which are known in perturbation theory at the NLO (Buras et al. + Ciuchini et al.)

$$\tau = -V_{ts}^{*} V_{td} / V_{us}^{*} V_{ud}$$

We have to compute $A^{I=0,2}_i = \langle (\pi\,\pi)_{I=0,2} \mid Q_i \mid K \rangle$ with a non perturbative technique (lattice, QCD sum rules, 1/N expansion etc.)



$$A_0 = \sum_i C_i(\mu) \langle (\pi\pi) | Q_i(\mu) | K \rangle_{I=0} (1 - \Omega_{IB})$$

μ = renormalization scale

μ-dependence cancels if operator matrix elements are consistently computed

Isospin Breaking

$$\mathcal{A}_2 = \sum_i C_i(\mu) \langle (\pi\pi) | Q_i(\mu) | K \rangle_{I=2}$$

Ω_{IB} = 0.25± 0.08 (Munich from Buras & Gerard)

0.25± 0.15 (Rome Group) 0.16± 0.03 (Ecker et al.)

0.10± 0.20 Gardner & Valencia, Maltman & Wolf, Cirigliano & al.

$$A^{I=0,2}{}_i(\mu) = \langle (\pi\,\pi)_{I=0,2}\, IQ_i(\mu) I\, K \rangle$$
$$= Z_{ik}(\mu\, a)\, \langle (\pi\,\pi)_{I=0,2}\, IQ_k(a) I\, K \rangle$$

Where $Q_i(a)$ is the bare lattice operator
And a the lattice spacing.

The effective Hamiltonian can then be read as:

$$\langle F \mid H^{\Delta S=1} \mid I \rangle = G_F/\sqrt{2} V_{ud} V_{us}{}^* \Sigma_i C_i(1/a) \langle F \mid Q_i(a) \mid I \rangle$$

In practice the renormalization scale (or 1/a) are the scales which separate short and long distance dynamics

GENERAL FRAMEWORK

$$\langle H^{\Delta S=1} \rangle = G_F/\sqrt{2}\, V_{ud}\, V_{us}^{*} \ldots \Sigma_i C_i(a) \langle Q_i(a) \rangle$$

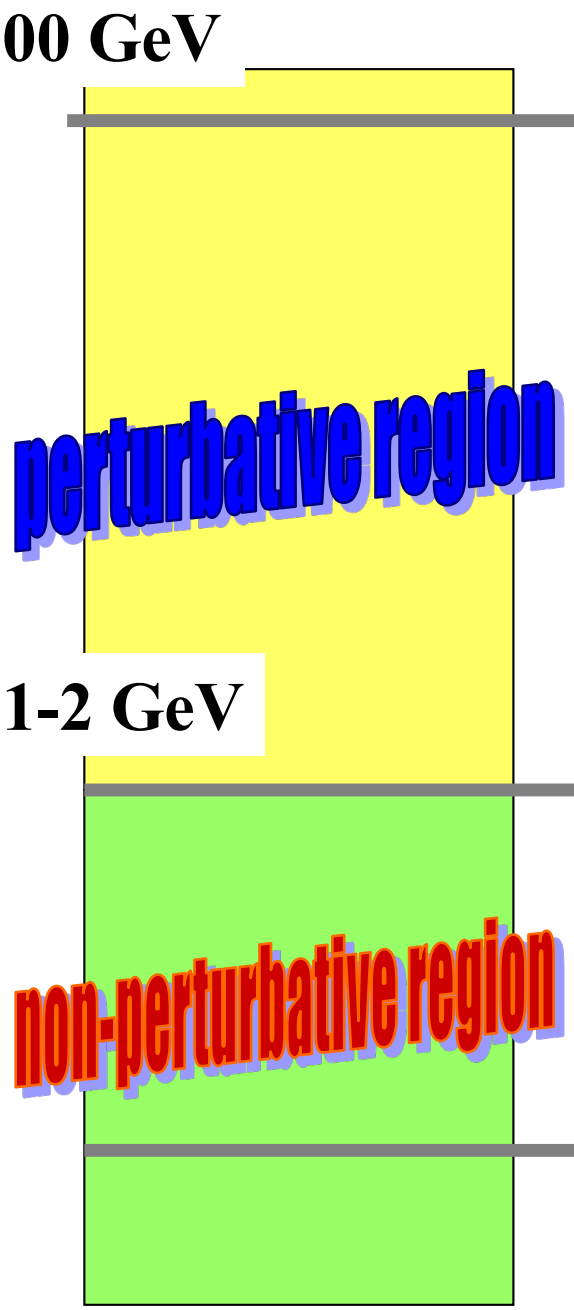
$M_W = 100$ GeV

Effective Theory - quark & gluons

$a^{-1} = 2\text{-}5$ GeV

Hadronic non-perturbative region

$\Lambda_{QCD}, M_K = \mathbf{0.2\text{-}0.5\ GeV}$



Large mass scale: heavy degrees of freedom (m_t , M_W, M_s) are removed and their effect included in the Wilson coefficients

renormalizazion scale μ (inverse lattice spacing 1/a); this is the scale where the quark theory is matched to the effective hadronic theory

Scale of the low energy process $\Lambda \ll M_W$

THE SCALE PROBLEM: Effective theories prefer low scales, Perturbation Theory prefers large scales

New local four-fermion operators are generated

$Q_1 = (\bar{s}_L{}^A \gamma_\mu u_L{}^B)\,(\bar{u}_L{}^B \gamma_\mu d_L{}^A)$ Current-Current

$Q_2 = (\bar{s}_L{}^A \gamma_\mu u_L{}^A)\,(\bar{u}_L{}^B \gamma_\mu d_L{}^B)$

$Q_{3,5} = (\bar{s}_R{}^A \gamma_\mu d_L{}^A) \sum_q (\bar{q}_{L,R}{}^B \gamma_\mu q_{L,R}{}^B)$ Gluon

$Q_{4,6} = (\bar{s}_R{}^A \gamma_\mu d_L{}^B) \sum_q (\bar{q}_{L,R}{}^B \gamma_\mu q_{L,R}{}^A)$ Penguins

$Q_{7,9} = 3/2(\bar{s}_R{}^A \gamma_\mu d_L{}^A) \sum_q e_q (\bar{q}_{R,L}{}^B \gamma_\mu q_{R,L}{}^B)$ Electroweak

$Q_{8,10} = 3/2(\bar{s}_R{}^A \gamma_\mu d_L{}^B) \sum_q e_q (\bar{q}_{R,L}{}^B \gamma_\mu q_{R,L}{}^A)$ Penguins

+ 10+ Chromomagnetic and electromagnetic operators

$$\mathcal{A}(K \to \pi\pi) = \sum_i C_W^i(\mu) \langle \pi\pi | O_i(\mu) | K \rangle$$

A simple argument for a (two) PhD thesis

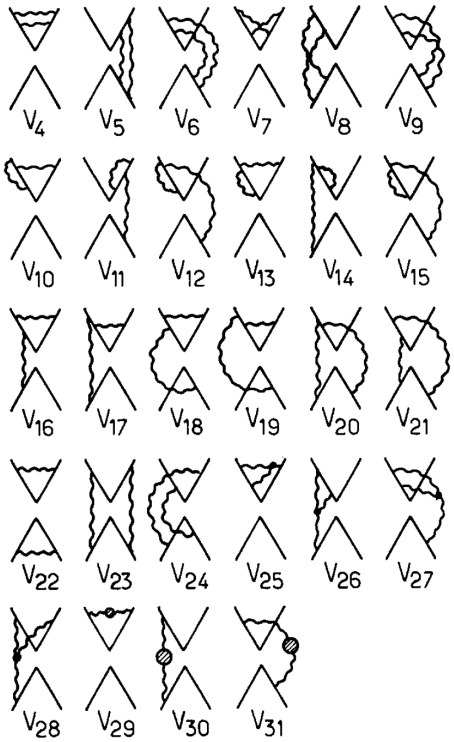


Fig. 10. Current–current diagrams at two loops.

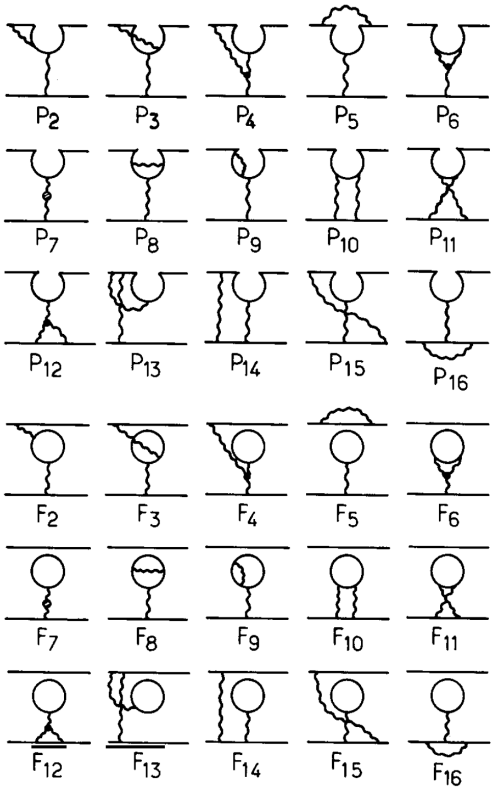


Fig. 11. Penguin diagrams at two loops.

After the detailed study of the one-loop diagrams, we are ready to show the construction of a "complete" two-loop diagram, including all necessary counter-

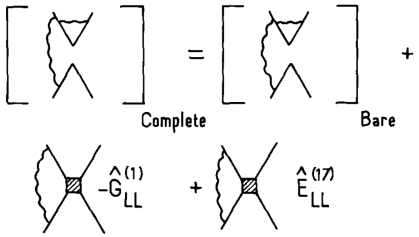


Fig. 13. Diagrammatic representation of the subtraction procedure for a current–current diagram. The "complete" diagram is obtained by summing the diagram with a bare operator inserted, the counterterms including those corresponding to effervescent operators and the term defined as $E^{(17)}_{LL}$ in eq. (90).

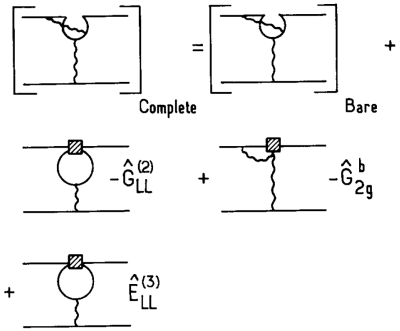


Fig. 14. Diagramatic representation of the subtraction procedure for a penguin diagram. The "complete" diagram is obtained by summing the diagram with a bare operator inserted, the counterterms including those corresponding to effervescent operators and the term defined as $E^{(3)}_{LL}$ in eq. (94). Also the two-gluon counterterm is shown.

- *about 60 distinct two loop topologies + counterterms*
- *Dirac and colour algebra by Schoonship*

(Marco was our ambassador with Tiny Veltman)

- *NDR and HV regularisation schemes*

Competition with the Munich group was very tought

- 9211304/9211321 the Munich group published first the results in the NDR scheme
- 9312203 the Rome group published a phenomenological analysis of ε'/ε
- 9304257 we completed our calculation in both NDR and HV with consistent results, the two diagrams in HV were corrected with respect to Munich

ϵ'/ϵ at the Next-to-leading order in QCD and QED #1

Marco Ciuchini (Rome, ISS and Rome U.), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome), L. Reina (SISSA, Trieste and INFN, Trieste) (Nov, 1992)

Published in: *Phys.Lett.B* 301 (1993) 263-271 • e-Print: hep-ph/9212203 [hep-ph]

pdf DOI cite claim reference search 270 citations

The Delta S = 1 effective Hamiltonian including next-to-leading order QCD and QED corrections #2

Marco Ciuchini (Rome, ISS and Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome and Ecole Normale Superieure), L. Reina (Brussels U.) (Apr, 1993)

Published in: *Nucl.Phys.B* 415 (1994) 403-462 • e-Print: hep-ph/9304257 [hep-ph]

pdf DOI cite claim reference search 526 citations

Two-loop anomalous dimensions & renormalisation schemes

we found that the variation of the two-loop anomalous dimension, due to the change of subtraction scheme

$$\Delta\hat{\gamma}_s^{(1)} = [\Delta\hat{r}, \hat{\gamma}_s^{(0)}] + 2\beta_0\Delta\hat{r}$$

can be verified diagram by diagram (group of).

Two diagrams of the Munich calculation in HV did not satisfied this relation

Let us jump foward a bunch of years (around 2000)

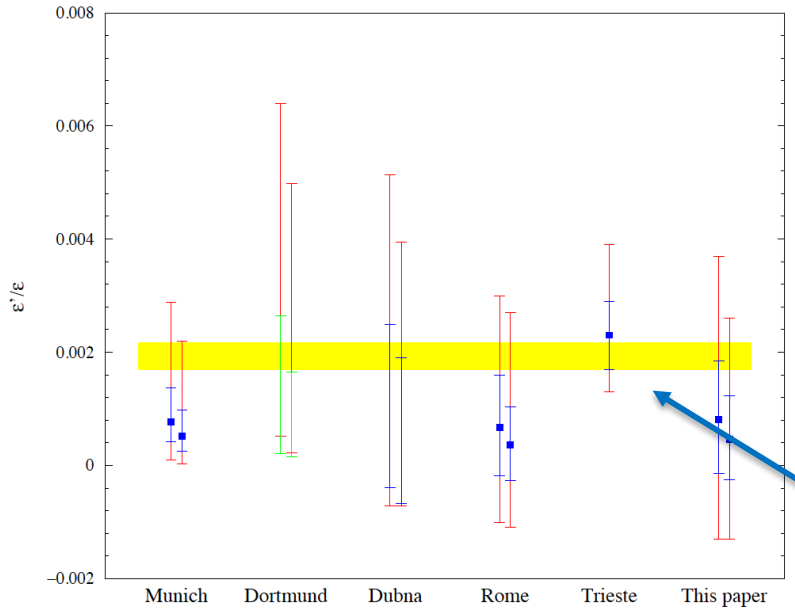


Figure 1: *Compilation of recent theoretical predictions for* ε'/ε.

TUM-HEP-376/00
RM3-TH/00-10

Theoretical status of ε'/ε ⋆

Marco Ciuchini [a] and Guido Martinelli [b]

[a] *Physik Dept., Technische Universität München, D-85748 Garching, Germany.*
Dip. di Fisica, Università di Roma Tre and INFN, Sezione di Roma III,
Via della Vasca Navale 84, I-00146 Rome, Italy.

[b] *Laboratoire de Physique Théorique (LPT), Université de Paris-Sud,*
Bâtiment 210, 91405 Orsay.
Centre de Physique Théorique de l'École Polytechnique,
91128 Palaiseau Cedex, France.

Abstract

We review the theory of ε'/ε and present an updated phenomenological analysis using hadronic matrix elements from lattice QCD. The present status of the computation of ε'/ε, considering various approaches to the matrix-element evaluation, is critically discussed.

chiral quark model
S. Bertolini, J.O. Eeg and M. Fabbrichesi,
hep-ph/0002234 and refs.
therein..

RBC-UK QCD

NEW PHYSICS IN KAON DECAYS?

$$\varepsilon'/\varepsilon = (1.4 \pm 7.0) \cdot 10^{-4}$$

$$\left(\frac{\mathrm{Re}\,A_0}{\mathrm{Re}\,A_2}\right) = 31.0 \pm 6.6$$

$$(\varepsilon'/\varepsilon)_{\mathrm{exp}} = (16.6 \pm 2.3) \cdot 10^{-4}$$

$$\left(\frac{\mathrm{Re}\,A_0}{\mathrm{Re}\,A_2}\right)_{\mathrm{exp}} = 22.4$$

Courtesy by A. Buras 2015

Results for $\mathrm{Re}[A_0]$, $\mathrm{Im}[A_0]$ and $\mathrm{Re}[\epsilon'/\epsilon]$

Xu Feng Lattice 2017

[RBC-UKQCD, PRL115 (2015) 212001]

- Determine the $K \to \pi\pi(I=0)$ amplitude A_0
  - Lattice results

$$\mathrm{Re}[A_0] = 4.66(1.00)_{\mathrm{stat}}(1.26)_{\mathrm{syst}} \times 10^{-7}\ \mathrm{GeV}$$
$$\mathrm{Im}[A_0] = -1.90(1.23)_{\mathrm{stat}}(1.08)_{\mathrm{syst}} \times 10^{-11}\ \mathrm{GeV}$$

  - Experimental measurement

$$\mathrm{Re}[A_0] = 3.3201(18) \times 10^{-7}\ \mathrm{GeV}$$
$$\mathrm{Im}[A_0] \text{ is unknown}$$

- Determine the direct CP violation $\mathrm{Re}[\epsilon'/\epsilon]$

$$\mathrm{Re}[\epsilon'/\epsilon] = 0.14(52)_{\mathrm{stat}}(46)_{\mathrm{syst}} \times 10^{-3} \quad \text{Lattice}$$
$$\mathrm{Re}[\epsilon'/\epsilon] = 1.66(23) \times 10^{-3} \quad \text{Experiment}$$

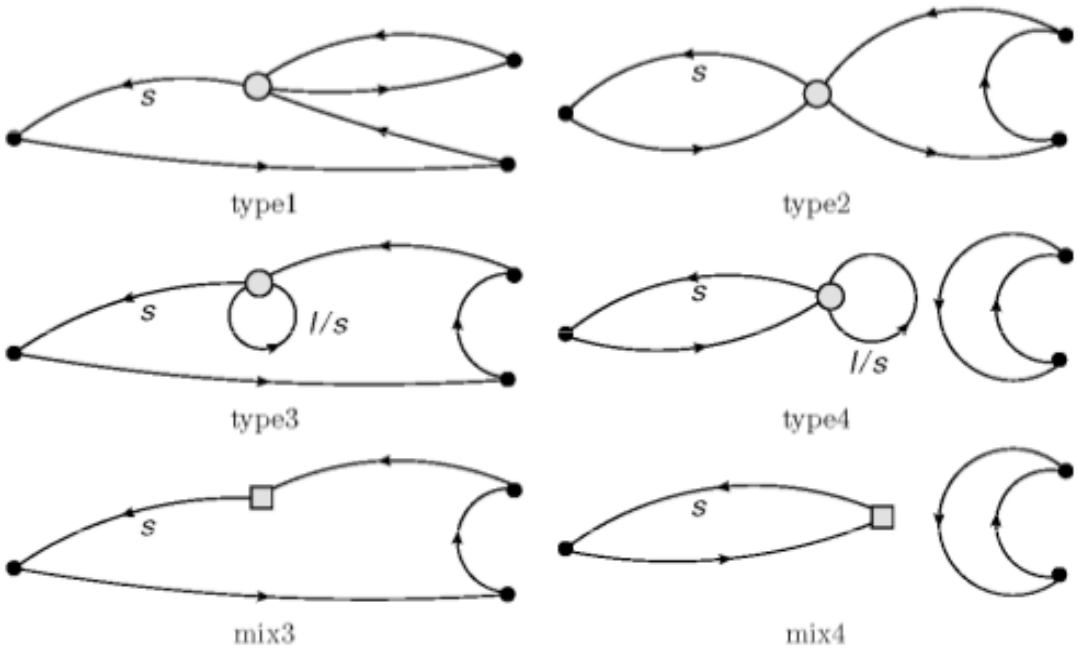
Phase of final state interaction smaller than the experimental value

2.1 σ deviation $\Rightarrow$ require more accurate lattice results

$\Delta I = 1/2$ $K \rightarrow \pi\pi$

(Qi Liu)

- Code 50 different contractions
- For each of 400 configurations invert with source at each of 32 times.
- Use Ran Zhou's deflation code



Systematic error budget

Christopher Kelly
(RBC & UKQCD collaborations)

Lattice2021, MIT, USA

- Primary systematic errors of 2015 work:
  - Finite lattice spacing: 12%
  - Wilson coefficients: 12%
  - Renormalization (mostly PT matching): 15%
  - Excited-state: ≤ 5% but now known to be significantly underestimated
  - Lellouch-Luscher factor (derivative of ππ phase shift wrt. energy): 11%
- In our new work we have used step-scaling to raise the renormalization scale from 1.53 → 4.00 GeV: 15% → 5%
- 3 operators have dramatically improved understanding of ππ system: Lellouch-Luscher factor 11% → 1.5%
- Detailed analysis shows no evidence of remaining excited-state contamination: Excited state error now negligible!
- Still single lattice spacing: Discretization error unchanged.
- Evidence that Wilson coefficient systematics are driven by using PT for 3-4f matching, not improved by higher μ:
  Wilson coeff error unchanged.

Final result for ε'

Whenever Utfit is quoted,
Marco is one of the authors
(and founder)

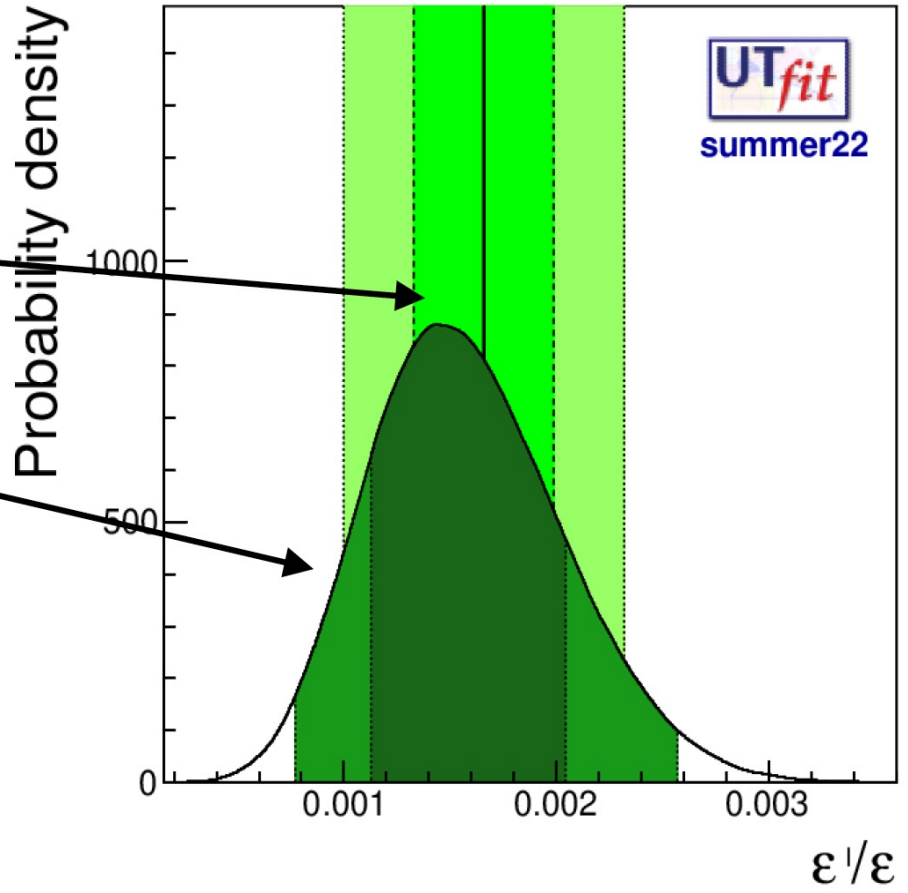
New ε'/ε prediction from the Unitarity Triangle fit

Lincei

Experimental value
$\varepsilon'/\varepsilon = (16.6 \pm 3.3) \cdot 10^{-4}$

New UTfit work:
$\varepsilon'/\varepsilon = (15.2 \pm 4.7) \cdot 10^{-4}$

RBC/UKQCD obtains:
$\varepsilon'/\varepsilon = (21.7 \pm 6.7 \pm 5.0_{IB}) \cdot 10^{-4}$
IB = isospin-breaking uncertainty



A second group should do this calculation!!

The Italian Team expands:
``il cucciolo'' Luca enters the game





#1

, Rome), L.

df DOI cite claim reference search 270 citations

Delta S = 1 effective Hamiltonian including next-to-leading order QCD and QED corrections #2

Ciuchini (Rome, ISS and Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and Rome and Ecole Normale Superieure), L. Reina (Brussels U.) (Apr, 1993)

hed in: *Nucl.Phys.B* 415 (1994) 403-462 • e-Print: hep-ph/9304257 [hep-ph]

df DOI cite claim reference search 526 citations

Scheme independence of the effective Hamiltonian for b ---> s gamma and b ---> s g decays #3

Marco Ciuchini (Rome, ISS and INFN, Rome and Rome U.), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome and Ecole Normale Superieure), L. Reina (Brussels U.), L. Silvestrini (Rome U. and INFN, Rome) (Jul, 1993)

Published in: *Phys.Lett.B* 316 (1993) 127-136 • e-Print: hep-ph/9307364 [hep-ph]

pdf DOI cite claim reference search 277 citations

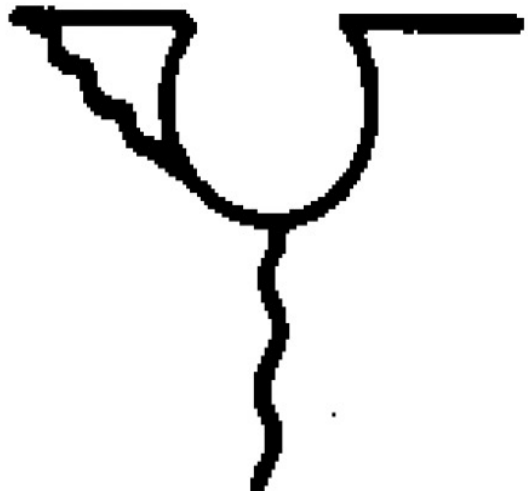
Radiative B decays and their phenomenological importance

$$b \to s\gamma \qquad B \to K^{(*)}\gamma$$

Triggered by two extra operators of the effective weak Hamiltonian

$$Q_7 = \frac{Q_d e}{16\pi^2} m_b \bar{s}_a \sigma^{\mu\nu}(1+\gamma_5) b_a F_{\mu\nu}$$

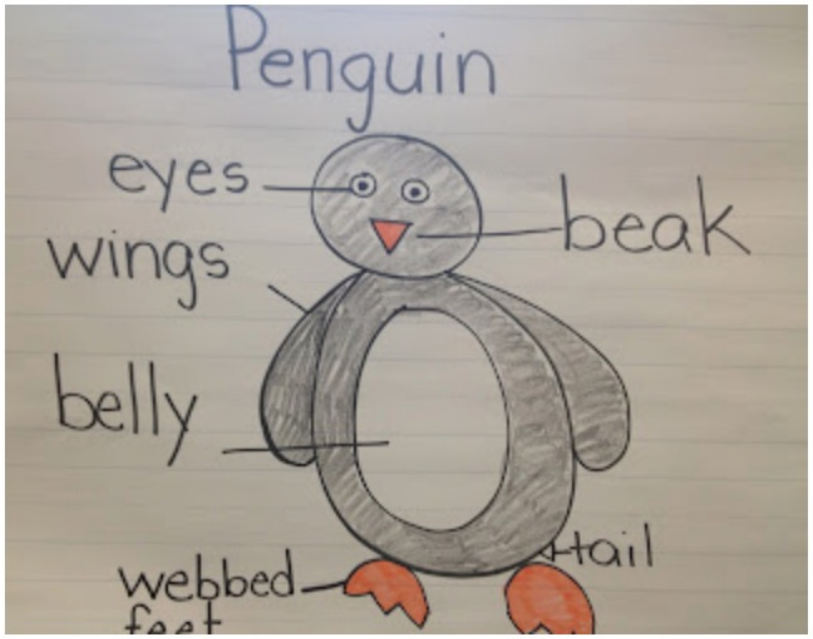
$$Q_8 = \frac{g_s}{16\pi^2} m_b \bar{s}_a \sigma^{\mu\nu}(1+\gamma_5) t^A_{ab}\, b_b\, G^A_{\mu\nu}$$



They appears at the LO only at two loops

At that time there where three calculations on the market

1) Grinstein, Springer and Wise 1988 NDR
2) Cella, Curci, Ricciardi 1990 (agree with 1))
3) Grigjanis,O'Donnel, Sutherland, Navelet, 1990 DRED (disagree with 1))



The difference at the LO was irreducible

Grigjanis et al. claimed it was an evidence of the failure of the DRED scheme

After endless meetings in a common room at the ENS, where I was spending a year , we identified

a $O(\alpha_s^0)$ 1-loop, scheme-dependent, finite mixing between $Q_{5,6}$ and $Q_{7,8}$

Once taken into account, the scheme independence of the LO Wilson coefficients was recovered!

The March of the Penguins

in their march the penguins become charming

Charming penguins in B decays #25

Marco Ciuchini (CERN), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome), L. Silvestrini (Rome U., Tor Vergata and INFN, Rome) (Mar, 1997)

Published in: *Nucl.Phys.B* 501 (1997) 271-296 • e-Print: hep-ph/9703353 [hep-ph]

pdf DOI cite claim reference search 263 citations

More seriously

$$B \to K^{(*)} \ell^+ \ell^-$$

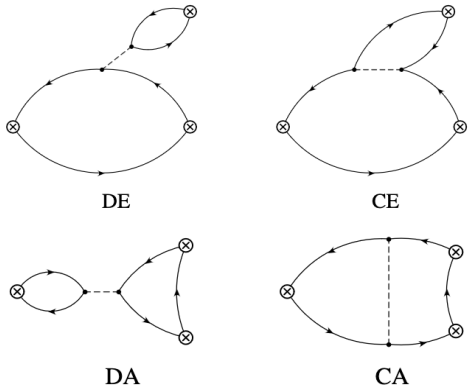


Figure 1: *Non-penguin diagrams. The dashed line represents the four-fermion operator.*

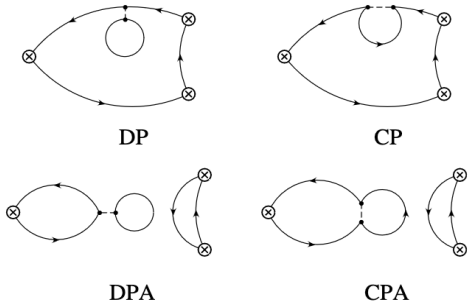
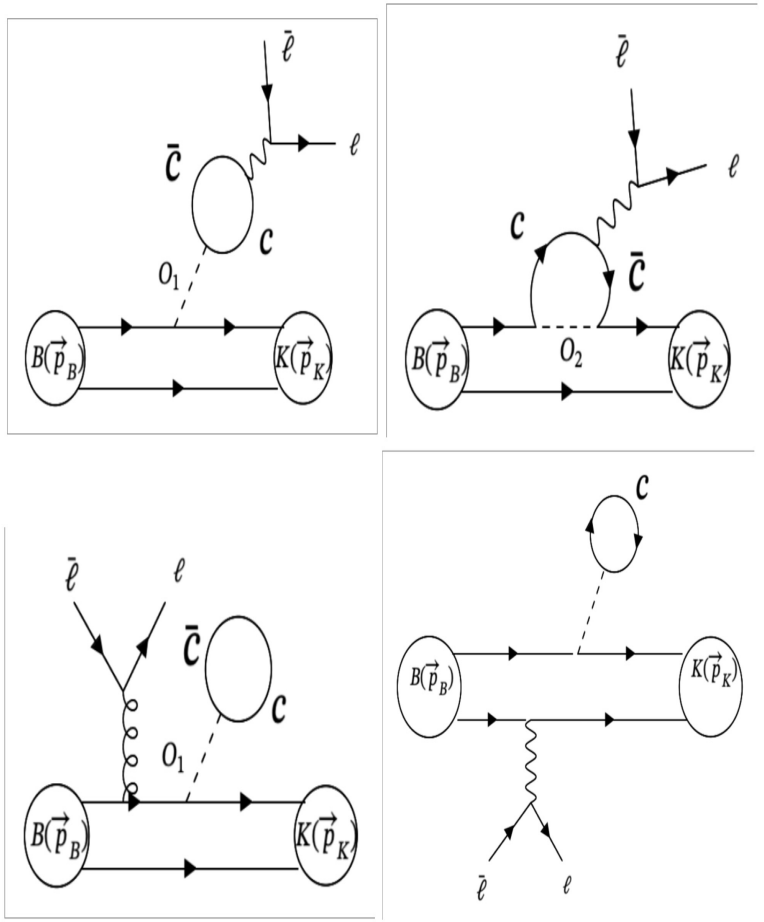
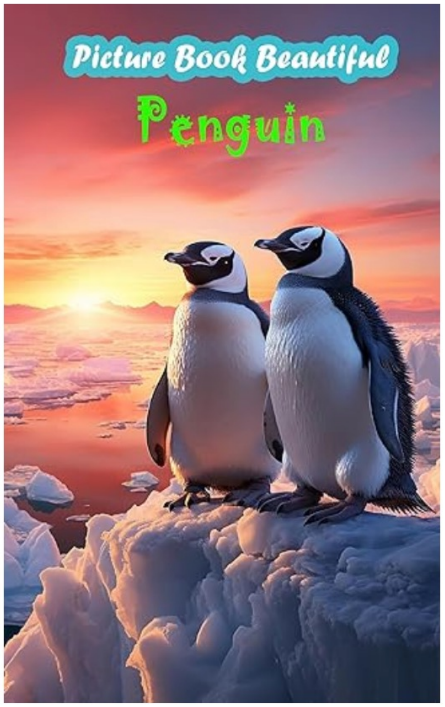


Figure 2: *Penguin diagrams.*



Books › Arts & Photography › Photography & Video



Charming Penguins: A Visual Symphony: Adorable Penguins Showcasing their Charm and Grace in Mesmerizing Imagery

Unfortunately
Autopsy
to confront
Buras Anatomy
was rejected

In 1997 started working in charmless non-leptonic B decays, soon to be measured at the B factories.
At that time, it was popular to use topological amplitudes combined with flavour symmetries.

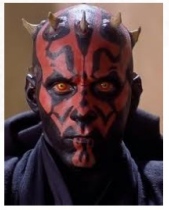
We felt we could do better using our previous experience with the effective Hamiltonian
Analysing the structure of operators and matrix elements, we identified a potentially large non-factorizable contribution which I proposed to call

"charming penguins"

Courtesy from Marco 2012

charming penguin saga

The penguin menace [1, 2]. A lattice-inspired Wick-contraction parametrization of hadronic amplitudes was introduced and the observation was put forward that non-factorizable penguin contractions of current-current operators containing two c quarks (the charming penguins) could give large contributions in some B decay channels, notably $B \to K\pi$ (a similar idea was already present in ref. [3]).



Marco

Andrzej   Luca

The neat hack of the clones [4]. The original Wick-contraction parametrization was modified by Buras and Silvestrini. The hadronic matrix elements were expressed in terms of new renormalization-group invariant parameters given by suitable combinations of the old ones.

A new hope [5, 6]. The one-loop proof that factorization of hadronic matrix elements holds in the limit $m_b \to \infty$ puts phenomenological approaches based on factorization on a firmer theoretical ground (other theoretical approaches to factorization in the infinite mass limit were already developed, although not at the same level of accuracy [7]). *In this limit*, non-factorizable corrections were shown to be computable using perturbation theory. Perturbative penguins turned out to give in general small contributions. Charming penguins seemed at loss.

Chris

Guido 

Charming penguins strike back [8]. Using $B \to K\pi$ data, it was shown that the parameter accounting for charming penguins has the expected size of a Λ_{QCD}/m_b correction.

The return of factorization [9, 10]. While everybody agrees that power-suppressed terms are in general non-perturbative and non-factorizable, it was argued that still the bulk of the Λ_{QCD}/m_b corrections can be either factorized or, failing that, accounted for by few parameters (this framework is called *improved* QCD factorization).

Chris  Martin

Charming penguin enhanced B decays

#28

Marco Ciuchini (CERN), R. Contino (Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome), L. Silvestrini (Munich U.) (Jul, 1997)

Published in: *Nucl.Phys.B* 512 (1998) 3-18, *Nucl.Phys.B* 531 (1998) 656-660 (erratum) • e-Print: hep-ph/9708222 [hep-ph]

pdf DOI cite claim reference search 125 citations

Next-to-leading QCD corrections to $B \to X_s\gamma$: Standard model and two Higgs doublet model

#29

Marco Ciuchini (INFN, Rome), G. Degrassi (CERN), P. Gambino (Munich, Max Planck Inst.), G.F. Giudice (CERN) (Oct, 1997)

Published in: *Nucl.Phys.B* 527 (1998) 21-43 • e-Print: hep-ph/9710335 [hep-ph]

pdf DOI cite claim reference search 468 citations

Next-to-leading order QCD corrections to Delta F = 2 effective Hamiltonians

#30

Marco Ciuchini (Rome, ISS), E. Franco (Rome U. and INFN, Rome), V. Lubicz (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome), I. Scimemi (Rome U. and INFN, Rome) et al. (Nov, 1997)

Published in: *Nucl.Phys.B* 523 (1998) 501-525 • e-Print: hep-ph/9711402 [hep-ph]

pdf DOI cite claim reference search 251 citations

Factorization, charming penguins, and all that

#31

Marco Ciuchini (INFN, Rome), R. Contino (Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome), L. Silvestrini (Munich, Tech. U.) (Jan, 1998)

Published in: *Nucl.Instrum.Meth.A* 408 (1998) 28-32 • Contribution to: Beauty 1997 • e-Print: hep-ph/9801420 [hep-ph]

pdf DOI cite claim reference search 12 citations

Model independent determination of the shape function for inclusive B decays and of the structure functions in DIS

#32

U. Aglietti (Rome U. and INFN, Rome), Marco Ciuchini (Rome, ISS), G. Corbo (Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome) et al. (Apr, 1998)

Published in: *Phys.Lett.B* 432 (1998) 411-420 • e-Print: hep-ph/9804416 [hep-ph]

pdf DOI cite claim reference search 39 citations

Model independent determination of the light cone wave functions for exclusive processes

#33

U. Aglietti (Rome U. and INFN, Rome), Marco Ciuchini (Rome III U. and INFN, Rome), G. Corbo (Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome) et al. (Jun, 1998)

Published in: *Phys.Lett.B* 441 (1998) 371-375 • e-Print: hep-ph/9806277 [hep-ph]

pdf DOI cite claim reference search 58 citations

Next-to-leading QCD corrections to B ---> X(s) gamma in supersymmetry

#34

Marco Ciuchini (Rome U. and INFN, Rome), G. Degrassi (Padua U. and INFN, Padua), P. Gambino (Munich, Tech. U.), G.F. Giudice (CERN) (Jun, 1998)

Published in: *Nucl.Phys.B* 534 (1998) 3-20 • e-Print: hep-ph/9806308 [hep-ph]

pdf links DOI cite claim reference search 380 citations

Delta M(K) and epsilon(K) in SUSY at the next-to-leading order

#35

Marco Ciuchini (Rome III U. and INFN, Rome), V. Lubicz (Rome III U. and INFN, Rome), L. Conti (INFN, Rome and Rome U., Tor Vergata), A. Vladikas (INFN, Rome and Rome U., Tor Vergata), A. Donini (Madrid, Autonoma U.) et al. (Aug, 1998)

Published in: *JHEP* 10 (1998) 008 • e-Print: hep-ph/9808328 [hep-ph]

pdf DOI cite claim reference search 293 citations

Heavy heavy form-factors and generalized factorization

#36

Marco Ciuchini (Rome III U. and INFN, Rome), R. Contino (Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome U. and INFN, Rome) (Oct, 1998)

Published in: *Eur.Phys.J.C* 9 (1999) 43-53 • e-Print: hep-ph/9810271 [hep-ph]

pdf DOI cite claim reference search 12 citations

The BABAR physics book: Physics at an asymmetric B factory

#37

BaBar Collaboration • D. Boutigny (Annecy, LAPP) et al. (Oct, 1998)

Contribution to: Workshop on Physics at an Asymmetric B Factory (BaBar Collaboration Meeting), Workshop on Physics at an Asymmetric B Factory (BaBar Collaboration Meeting), Workshop on Physics at an Asymmetric B Factory (BaBar Collaboration Meeting), Workshop on Physics at an Asymmetric B Factory (BaBar Collaboration Meeting)

pdf links DOI cite claim reference search 641 citations

Penguin amplitudes: Charming contributions

#39

Marco Ciuchini (INFN, Rome3 and Rome III U.), E. Franco (INFN, Rome and Rome U.), G. Martinelli (INFN, Rome and Rome U.), L. Silvestrini (Munich, Tech. U.) (Jun, 1999)

Contribution to: 1999 Chicago Conference on Kaon Physics (K 99), 335-339 • e-Print: hep-ph/9909530 [hep-ph]

pdf cite claim reference search 9 citations

Epsilon-prime / epsilon from lattice QCD

#40

Marco Ciuchini (Rome III U. and INFN, Rome3), E. Franco (Rome U. and INFN, Rome), Leonardo Giusti (Boston U.), V. Lubicz (Rome III U. and INFN, Rome3), G. Martinelli (Rome U. and INFN, Rome) (Jun, 1999)

Contribution to: 1999 Chicago Conference on Kaon Physics (K 99), 305-317 • e-Print: hep-ph/9910237 [hep-ph]

pdf cite claim reference search 58 citations

Combined analysis of the unitarity triangle and CP violation in the standard model

#41

Marco Ciuchini (Rome III U. and INFN, Rome3), E. Franco (Rome U. and INFN, Rome), Leonardo Giusti (Boston U.), V. Lubicz (Rome III U. and INFN, Rome3), G. Martinelli (Rome U. and INFN, Rome) (Oct, 1999)

Published in: *Nucl.Phys.B* 573 (2000) 201-222 • e-Print: hep-ph/9910236 [hep-ph]

pdf DOI cite claim reference search 65 citations

Computation of quark mass anomalous dimension at O(1 / N**2(f)) in quantum chromodynamics

#42

Massimiliano Ciuchini (Liverpool U.), Sergey E. Derkachov (Liverpool U. and St. Petersburg Inst. Tech.), J.A. Gracey (Liverpool U.), A.N. Manashov (Regensburg U. and St. Petersburg State U.) (Dec, 1999)

Published in: *Nucl.Phys.B* 579 (2000) 56-100 • e-Print: hep-ph/9912221 [hep-ph]

pdf DOI cite claim reference search 45 citations

Final state interactions and epsilon-prime / epsilon: A Critical look

#43

A.J. Buras (Munich, Tech. U.), Marco Ciuchini (Munich, Tech. U. and Rome III U. and INFN, Rome3), E. Franco (Munich, Tech. U. and Rome U. and INFN, Rome), G. Isidori (Munich, Tech. U. and Frascati), G. Martinelli (Rome U. and INFN, Rome and Orsay, LAL and Orsay) et al. (Feb, 2000)

Published in: *Phys.Lett.B* 480 (2000) 80-86 • e-Print: hep-ph/0002116 [hep-ph]

pdf DOI cite claim reference search 51 citations

Theoretical status of epsilon-prime / epsilon

#44

Marco Ciuchini (Munich, Tech. U. and Rome III U. and INFN, Rome3), Guido Martinelli (Orsay, LPT and Ecole Polytechnique) (Jun, 2000)

Published in: *Nucl.Phys.B Proc.Suppl.* 99 (2001) 27-34, *Frascati Phys.Ser.* 17 (2000) 445-462 • Contribution to: International Conference on CP Violation Physics, 27-34, 14th Rencontres de Physique de la Vallee d'Aoste: Results and Perspectives in Particle Physics, 445-462 • e-Print: hep-ph/0006056 [hep-ph]

pdf DOI cite claim reference search 65 citations

2000 CKM triangle analysis: A Critical review with updated experimental inputs and theoretical parameters #45

Marco Ciuchini (Rome III U. and INFN, Rome3), G. D'Agostini (Rome U. and INFN, Rome), E. Franco (Rome U. and INFN, Rome), V. Lubicz (Rome III U. and INFN, Rome3), G. Martinelli (Rome U. and INFN, Rome) et al. (Dec, 2000)

Published in: *JHEP* 07 (2001) 013 • e-Print: hep-ph/0012308 [hep-ph]

pdf DOI cite claim reference search 454 citations

Penguin contractions and factorization in B -> K (pi) decays

Marco Ciuchini (Rome III U. and INFN, Rome3), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome Pierini (Rome U. and INFN, Rome), L. Silvestrini (Rome U. and INFN, Rome) (Feb, 2001)

Contribution to: 4th International Conference on B Physics and CP Violation (BCP 4), 94-97 • e-Print: he

pdf DOI cite claim referer

Charming penguins strike back

Marco Ciuchini (Rome III U. and INFN, Rome3), E. Franco (Rome U. and INFN, Rome), G. Martinelli (Rome Pierini (Rome U. and INFN, Rome), L. Silvestrini (Rome U. and INFN, Rome) (Apr, 2001)

Published in: *Phys.Lett.B* 515 (2001) 33-41 • e-Print: hep-ph/0104126 [hep-ph]

pdf DOI cite claim

Two-body B decays, factorization and Lambda(QCD) / m(b) corrections

Marco Ciuchini (Rome III U. and INFN, Rome3), E. Franco (Rome U. and INFN, Rome), G. Mart Pierini (Rome U. and INFN, Rome), L. Silvestrini (Rome U. and INFN, Rome) (Oct, 2001)

Published in: *AIP Conf.Proc.* 602 (2001) 1, 180-193 • Contribution to: QCD@Work 2001, 18 ph]

pdf DOI cite claim

Next-to-leading order QCD corrections to spectator effects in lifetimes of

Marco Ciuchini (Rome III U. and INFN, Rome3), E. Franco (Rome U. and INFN, Rome), V. Lubi Mescia (Rome U. and INFN, Rome3) (Oct, 2001)

Published in: *Nucl.Phys.B* 625 (2002) 211-238 • e-Print: hep-ph/0110375 [hep-ph]

pdf DOI cite claim

Status of the CKM matrix

Marco Ciuchini (Rome III U. and INFN, Rome3) (Dec, 2001)

Published in: *Nucl.Phys.B Proc.Suppl.* 109 (2002) 307-314 • Contribution to: 7th Topical Se (Siena 2001), 307-314 • e-Print: hep-ph/0112133 [hep-ph]

pdf DOI cite claim

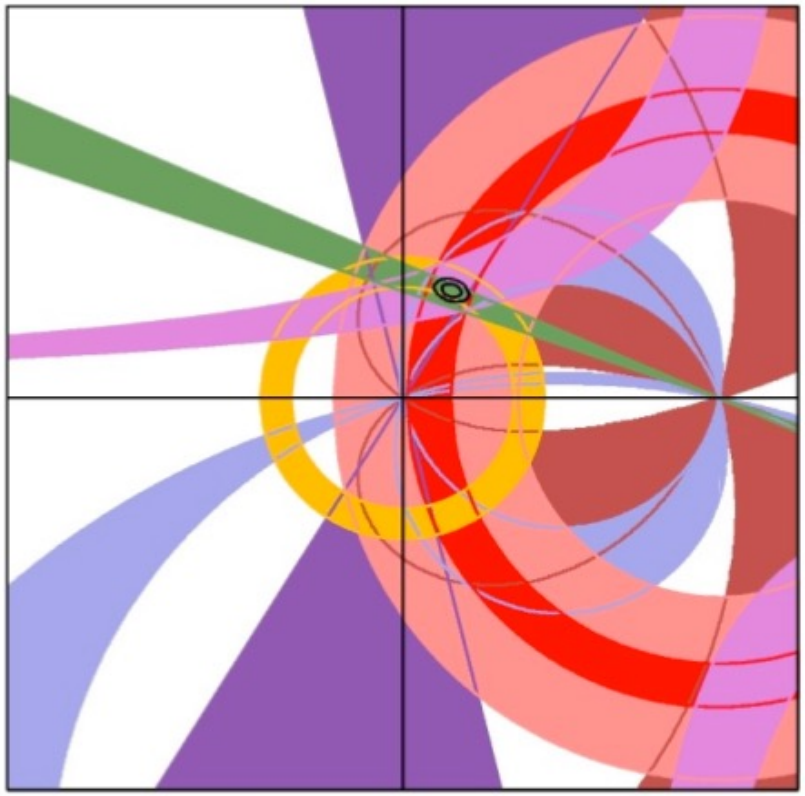
The Fatwa against
Our Bayesian Analysis

death to heretics, their supporters and the suspicions of a false faith (666)

Only the Holy Frequentistic Approach is allowed by Orthodoxy namely CKM-Fitter

AMEN (and Planck?)

On Utfit I will give the floor to Marcella Bona



Let us discuss now scientific tourism

PINGUINI TATTICI NUCLEARI

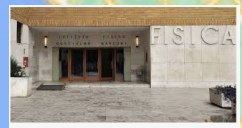
in tournée

radiative penguins 93-94

UTfit 00-24 + ZIZ

Cervinia

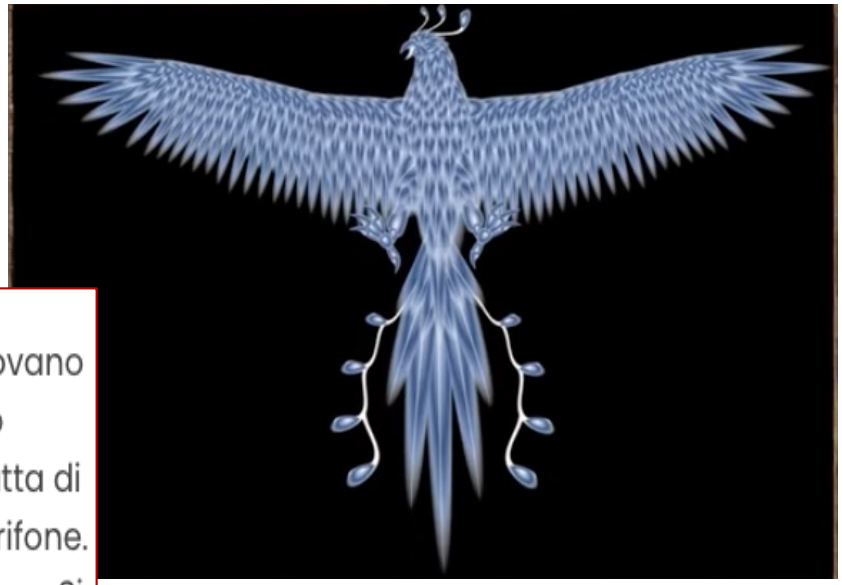
charming penguins 97-04



NLO penguins 90-92

Amsterdam
Paesi Bassi
Londra
Berlino
Germania
Belgio
Lussemburgo
Praga
Cechia
Parigi
Monaco di Baviera
Vienna
Austria
Francia
Svizzera
Lione
Slovenia
Croazia
Bosnia ed Erzegovina
Firenze
Monaco
Marsiglia
Italia
Andorra
Barcellona
Porto
Palma di Maiorca
Valencia
Lisbona
Podgorica
Tirana
Palermo

Sapete che ZIZ è il nome che i Fenici diedero a Palermo...?
Nella loro lingua significava fiore.



Nella cultura ebraica esistono diverse creature mitologiche. Alcune si ritrovano nelle tradizioni folcloristiche di questo popolo, mentre altre si menzionano addirittura nelle Sacre Scritture. Lo Ziz è giustappunto una di queste. Si tratta di un enorme e straordinario uccello, dalle sembianze simili a quelle di un grifone. In altre narrazioni lo Ziz prende il nome di Bar-Yuchnei, oppure di Bar Juchne. Si riteneva che le sue ali fossero talmente larghe da occludere la luce solare. Ma un'altra dote dello Ziz è la voce tonante, della quale vedremo la primaria funzione.

Speriamo di continuare a incontrarsi e collaborare per molto tempo ancora

Grazie Marco per
la preziosa collaborazione
e
l'amicizia

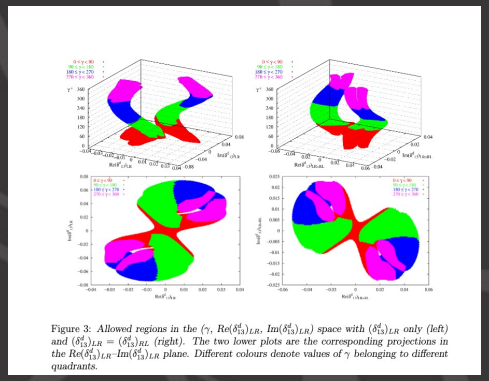


Figure 3: *Allowed regions in the* $(\gamma, Re(\delta^d_{13})_{LR}, Im(\delta^d_{13})_{LR})$ *space with* $(\delta^d_{13})_{LR}$ *only (left) and* $(\delta^d_{13})_{LR} = (\delta^d_{13})_{RL}$ *(right). The two lower plots are the corresponding projections in the* $Re(\delta^d_{13})_{LR}$–$Im(\delta^d_{13})_{LR}$ *plane. Different colours denote values of* γ *belonging to different quadrants.*

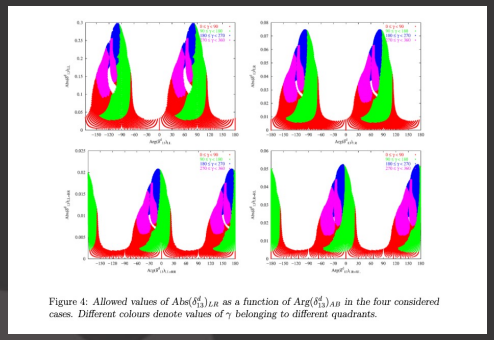


Figure 4: *Allowed values of* $Abs(\delta^d_{13})_{LR}$ *as a function of* $Arg(\delta^d_{13})_{AB}$ *in the four considered cases. Different colours denote values of* γ *belonging to different quadrants.*

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