

About the Horizon of J.-C. Raynal

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About the Horizon of J.-C. Raynal

At this Memorial Meeting we have heard about Jean-Claude as a colleague, co-author, friend in different directions, namely to `paint' him as a person:

His broad `horizon' as a physicist for fundamental dynamics

-- $|V(qb)|_{incl.}$ vs. $|V(qb)|_{excl.}$

-- some models are much better than many - **`judgment'** !

-- Hadrodynamics vs. HEP

-- Electric Dipole Moment

-- Paris connects different cultures

I. $|V(qb)|_{incl}$ vs. $|V(qb)|_{excl}$

Yes, data are the referees in the end -- however best fitted analyses often do *not* give us the best information about the underlying dynamics - i.e., theorists should *not* be the *slaves of the data*

There is still a long road in front of `us' - but the `young' people should remember about the progress where J.-C. contributed in many ways!

Actually it is a good "team":

Jean-Claude, Alain, Luis, Olivier who have worked in local & discrete worlds - however, *they have not gotten fair credit for their achievements* [I can say that without be biased]

I.1 $|V(cb)|_{incl}$ vs. $|V(cb)|_{excl}$

$$\Gamma(B \rightarrow l\nu X_c) \approx \Gamma(B \rightarrow l\nu [D, D^*, D^{**}, D\pi, D^*\pi, \dots])$$

On the left side for inclusive decays:

One uses well tested tools about QFT:

OPE, HQE, (subtle) duality

On the right side for exclusive ones:

situation with $\Gamma(B \rightarrow l\nu [D, D^*, D^{**}_{narrow}])$ is fine

beyond that it is 'complex' for $D^{**}_{broad}, D\pi, D^*\pi, \dots$

Of course 'we enjoy' discussions

Look at Jean-Claude, Alain, Luis, Olivier & Kolya and their records!

Can *radials* & D-waves resolve '1/2 > 3/2' paradox?

I hope three of those will continue their 'enjoyments'

I.2 Non-leptonic decays

As we know (although it is often forgotten):

One of the strengths of the SM are the connection with different regions of dynamics

[again: best fitted analyses often do *not* give us the best information about the underlying dynamics]

In this case:

$$B \rightarrow \pi X_c \text{ like } X_c = D^*, D^{3/2, 1/2}, \dots$$

Jean-Claude, Alain, Luis, Olivier had worked on this item for a long time (as you can see in Memorial Book for Kolya Uraltsev)

Three points:

- we can learn novel information about non-perturbative QCD
- it is a testbed for LQCD
- compare $B \rightarrow \pi X_c$ vs. $B_s \rightarrow K X_c$

I.3 Comment about $|V(ub)|_{incl}$ vs. $|V(ub)|_{excl}$

The landscape of "duality" is very complex:

One `camp': $|V(ub)|_{incl.} > 0.004$

Three `camps': $|V(ub)|_{excl.} < 0.004$

Three options:

(a) We do not understand inclusive transitions

(b) We might underestimate uncertainties in $B \rightarrow l \nu \pi$;

we can test with $B \rightarrow l \nu \pi \pi$ using **dispersion relations**

(c) New Dynamics hiding in the correlations in CKMfitter

I prefer option (c) & also happy with (b) in addition.

There are different `cultures' in hadrodynamics vs. HEP.

Duality between the worlds of hadrons & quarks

$$T(B_q \rightarrow l \nu [\pi's + \bar{K}K\pi's]) \approx T([b\bar{q}] \rightarrow l \nu u\bar{q}), \quad q = u, d$$

I use "duality" in discussions with HEP *including* re-scattering !

The claimed value of $|V(ub)|_{incl.}$ is actually smaller due to combination of two factors, namely enhanced resonance(s) of $\bar{K}K$ & $\bar{K}K\pi$ being close to a threshold.

Data:

-- $BR(B \rightarrow l + \nu X_u) \sim 2 \times 10^{-3}$;

-- B^+ & B^0 produce $\sim 20\%$ of those with one hadron;
multi-body FS give $\sim 80\%$ with narrow & broad resonances

Could they have pairs $K\bar{K} + \text{pions}$?

there are four classes $\Delta S=0$ resonances;

Class I: mostly pions; Class II: some KK ;

Class III: mostly pairs of K ;

Class IV, where we know little

-- get more data and use better analyses in 1 - 2 GeV
to be fair with this idea: it falls first on the
shoulders of our experim. colleagues.

II. Cultures between Hadrodynamics & HEP

One has to connect two worlds of theorists, namely with a different landscape, namely

-- *HEP theorists* work with quarks.

-- *hadrodynamics theorists* work using pions, kaon exchanges.

II. Cultures between Hadrodynamics & HEP

-- Some sum rules are very good, since they can connect with fundamental dynamics like Bjorken & Uraltsev sum rules as discussed today. Important question is: how large is the region where it can be applied.

-- Some models are very good, while others are not. One excellent example:

Bakamjian & Thomas (1953!); BT had been applied for nuclear physics obviously without even thinking about quarks, but not in HEP.

Jean-Claude, Alain, Luis, Olivier realized that BT model describes relativistic quark model in the HQ limit -- and satisfied Uraltsev sum rules.

Furthermore it gives more test bed for LQCD.

We have to give credit to the `team'!

I go to the history about fundamental dynamics:

Previously our community had talked about

NP → HEP

People working in HEP said: "We need more energy"

We had realized we had entered a new era
Nuclear physics ↔ Hadrodynamics ↔ HEP

different ways to probe fundamental dynamics:

- higher energy collisions or more accuracy or combining both
- for example: ATLAS & CMS & LHCb & Belle II

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accuracy -- with a new player - Hadrodynamics -
& new strategy: alliance, not competition

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like Jean-Claude, Alain, Luis, Olivier (including LQCD)

Allow me analogy about music:

One of my favored opera:

“The Magic Flute” (Mozart/Schnikaneder)

“Triumph of courage, virtue & wisdom”

I would say the same with different words different
sequence:

“Symmetry, thinking, not giving up”

III. Electric Dipole Moment (EDM)

I had written several books, reviews, summer schools, where I had talked about EDMs;

However, I had not referred to a published paper, namely:

Gavela, Le Yaouanc, Oliver, Pene, Raynal, Pham
Phys.Lett. 109B (1982) 215

[by 1982 I had published only two papers about CPV/CPTV !]

I hope you can forgive me that !

III. Electric Dipole Moment (EDM)

I want several points:

-- As said above, it shows the broad horizon of my French & Spanish colleagues.

-- I might disagree with some statements about uncertainties or the words, but it does not matter; It is a very good paper with deeper understanding of underlying dynamics.

-- Furthermore I am now working on a paper about $\Lambda \rightarrow p\pi^-$, $p\pi^-\gamma$, etc. and CPV in $\psi \rightarrow \bar{\Lambda} \Lambda \rightarrow p\pi^- \bar{p}\pi^+$ using somewhat similar tools.

Quote of Marinus

(~468 AD student of Proklos, known Neoplatonist Philosopher):

“ Only *being* good is one thing -
but good *doing* it is the other one! “

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One example:

Jean-Claude, Alain, Luis, Olivier did it!

There are three kingdoms in the QCD empire

- ↔ perturbative QCD
- ↔ lattice QCD
- ↔ heavy quark theory

& the Free Mason association of quark model craftsmen

We came here due to bad news: J.-C. passed away,
but we cannot give up --
there is even more on stake:

Exposition at the Institut Du Monde Arabe

"L'Age d'or des sciences arabes"

[25 oct. 2005 - 19 mars 2006]

Remember:

"Peu de science vaut mieux que beaucoup de devotion."

Hadith

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Paris wonderfully connects different cultures

Notre Dame de Paris <-> Institut Du Monde Arabe

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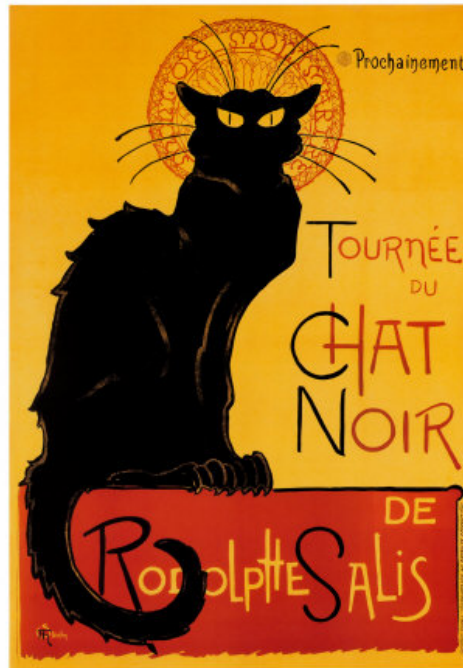
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I am serious -- "On ne passe pas"

we have to follow the same road in different ways.
I give you an analogue about French culture.

"Chat noir"



Rodolphe Salis master of ceremonies:
here: **Damir**