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QNP-2004: Penultimate Comments

Life in Exciting Times

1) What we agree on.

2) Extraordinary claims.

3) Words of wisdom.

1) What we agree on.

It was QNP-2004.

It was 23-28 May 2004 at IU.

We are very grateful to the organizers (co-chairmen A.Dzierba and A.Szczepaniak) for their hard work in arranging a very interesting and exciting meeting.

(pause for applause for the organizers and their associates)

1) What we agree on. (cont.)

We heard about a wide range of interesting topics from expert speakers.

The speakers were

(plenary):

T.Thomas, A.Dzierba, C.Gagliardi, A.Opper, Z.Meziani, J.Arrington, M.Battaglieri, J.Negele, W.Melnitchouk, N.Makins, J.Speth, A.Sibirtsev, I.Shipsey, T.Barnes, T.Nakano, P.Stoler, D.Christian, M.Longo, M.Wagner, M.Wang, D.Barna, The Pentaquark Ensemble, F.Bradamante, P.Hoyer, K.deJager and H.Stoeher.

and…

1) What we agree on. (cont.)

(parallel, some kinematic reflection):

M.Moshinsky, E.J.Stephenson, V.Druzhinin, N.Cook, A.Gardestig, D.C.Peaslee, S.Teige, S.Ahmed, B.Julia-Diaz, L.Lesniak, J.Marton, J.Narebski, Y.Gavrilov, I.Katchaev, B.Li, G.Adams, L.Gan, G.Krein, M.Nozar, T.Lahde, J.Kuhn, B.Li, M.Swat, S.Cotanch, S.Sanyal, K.Brinkman, D.Peaslee, E.Arriola, A.Krassnigg, M.Paris, W.Lee, A.Bogatyrev, F.Yuan, P.Bowman, J.Dudek, V.Muccifora, B. van de Sande, N.Poplawski, V.Mokeev, A.Kizilersu, T.Goldman, A.Szczurek, A.Kalloniatis, D.Lichtenberg, M.Gupta, H.Kwee, S.Koulaguine.

ca. 70 presentations, thanks to everyone for your efforts.

1) What we agree on. (cont.)

Plenary Topics (a quick rush through all topics but one):

LGT, as applied to spectroscopy (glueballs, exotics, baryons), form factors, parton distributions (moments), nucleon structure, radiative transitions, pentaquarks,…, future facilities! (Thomas, Negele)

The LGT danger: Ans = 42.3 pm 0.5 pm 0.8

"I'm a theorist; I want to understand things." -JN

How bad is the quenched approximation? Perhaps worse than has been appreciated. Time will tell.

What can the lattice NOT do yet?
Strong cross sections and decays, alas.

Plenary Topics (facilities)

GlueX (exotic mesons from photoproduction) (Dzierba)

RHIC and evidence for the QGP. (Gagliardi)
v_2 (elliptic flow), $T_c \sim 175$ MeV thermalization, back-jet quenching.
They have made an ellipsoidal something. QGP or not QGP?

Cleo-c (heavy-Q physics, CKM, semilept, spec.) (Shipsey)

COMPASS (status, first results; pol. str. functs) (Bradamante)

Future of hadron physics, US: RHIC, JLab, EICs. Had. beams?
LQCD (de Jager)

Hadron physics, EU: MAMI, ELSA, DAPHNE, HERMES,
COMPASS; CELSIUS, COSY, GSI, COMPASS,
(Stroeher)

Plenary Topics (specific physics topics)

CSB in low-E processes and affect on SM tests (Opper)

Large-x parton distn functions; pQCD, CQM and LGT (Meziani)

N form factors, clear departure from dipole formulas. (Arrington)

Vector meson photoproduction (Battaglieri)

Quark-hadron duality in structure functions (Melnitchouk)

Parton distribution functions (Makins)

Giant dipole resonances (Speth)

Regge description of meson photoprod (Sibirtsev)

X(3872) and D_{sJ} states (Barnes)

FSI in DIS, diffraction mechanisms (Hoyer)

Plenary Topics (specific physics topics, cont.)

…and the Θ

Let me just recall some of what we decided about the theta.
Its partner state candidates will rise or fall with it.
(More to follow (Dzierba)).

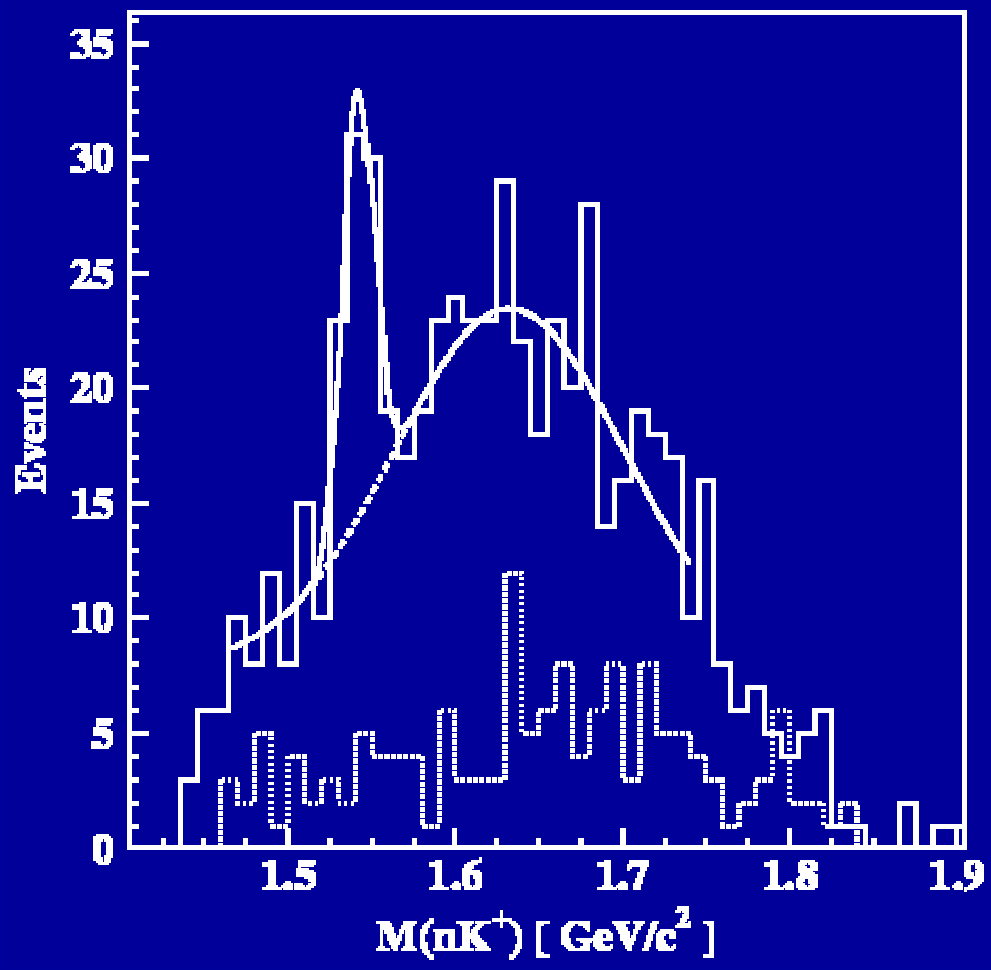
Part. 2) Extraordinary claims.

A picture of the pentaquark (also found on the web):

2) Extraordinary claims...

… require extraordinary standards of proof.

Θ(1542)



A $q^4\bar{s}$ flavor-exotic baryon???

My worry:

Past experience suggests that light-q multiquark states are either extremely broad or don't exist as resonances at all.

"Fall-apart decay" = rearrange to KN. Not a decay at all, instead the state is already part continuum.

High-statistics experiments settled the question of the existence of previous narrow resonances.

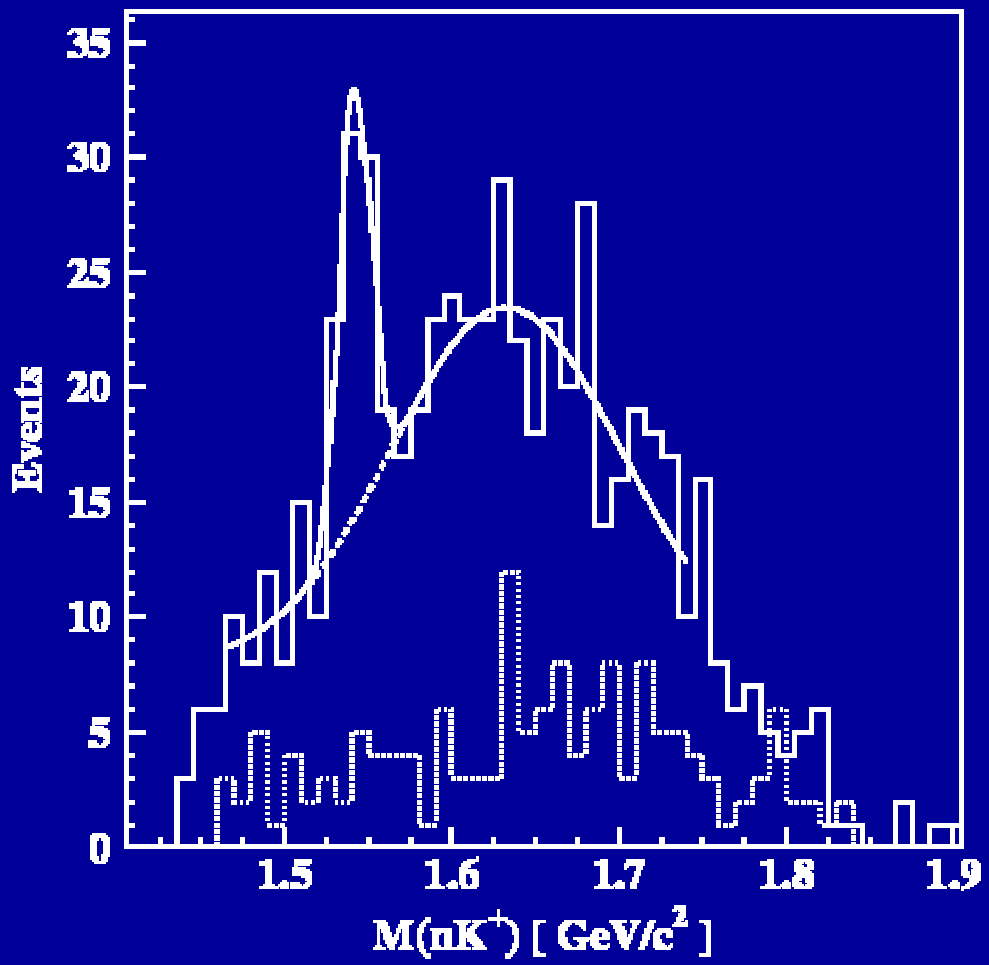
ζ(8.3) S(1936) ξ(2230) …

These didn't survive. Be cautious.

e.g.

Not **"We have discovered…",** you don't know that for certain, and you may eventually conclude otherwise. Instead, **"We have evidence for…".**

Θ(1542)



A $q^4\underline{s}$ flavor-exotic baryon???

Possible non-resonant explanations:

nK^+ :

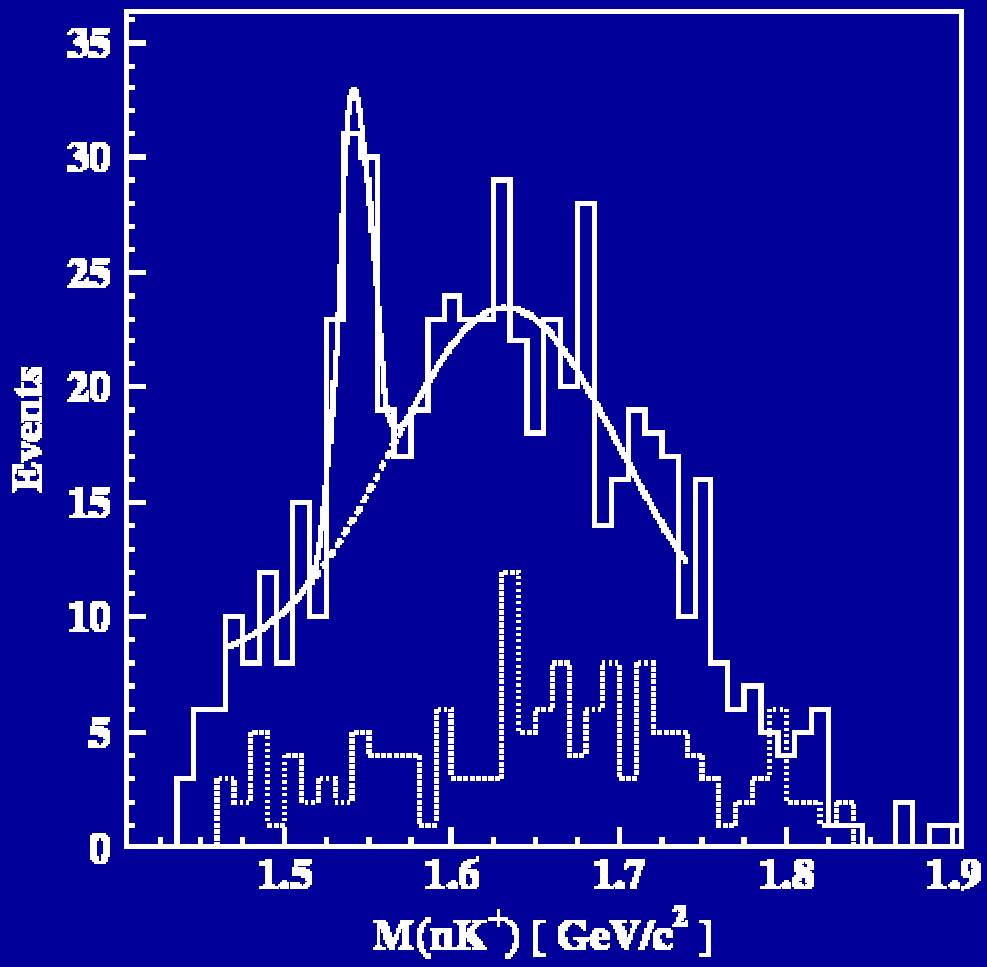
Uneven background due to kinematic reflection of higher-spin meson resonances in the K^+K^- cross-channel?

Tests:

With high stats the narrow Θ signal will broaden.

With different $E\gamma$ it will move in M_{nK+}.

Θ(1542)



A $q^4\underline{s}$ flavor-exotic baryon???

Possible non-resonant explanations:

nK^+ :

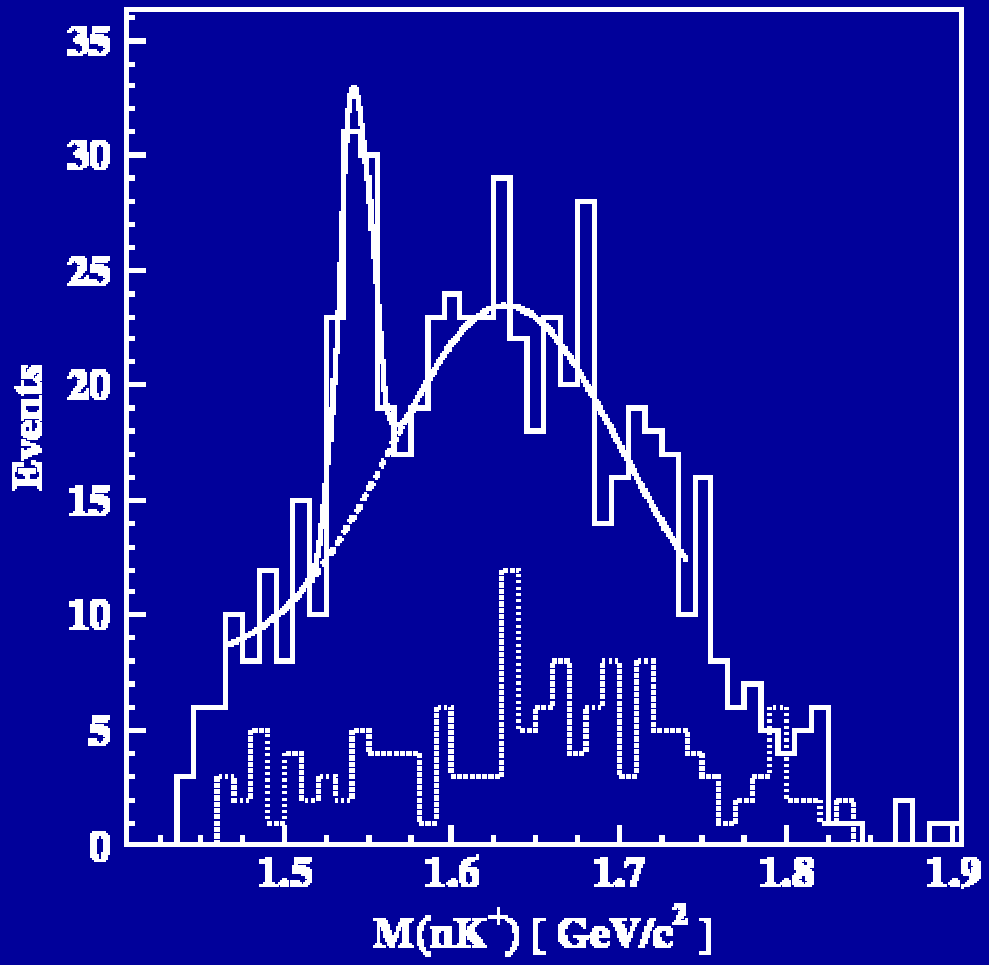
Kinematic reflection of higher-spin meson resonances decaying to K^+K^- in cross-channel?

(cont.)

This would affect low-E experiments but not high-E ones, and might explain why the Θ in nK^+ only appears in low-E experiments.

Careful determination of K^+K^- resonance content of the Dalitz plot will test the speculated reflection effect.

$\Theta(1542)$



We should also study strange baryon spectroscopy!

A $q^4\bar{s}$ flavor-exotic baryon???

Possible non-resonant explanations:

pK_s:

Ghost effect? (M.Longo)

1) Start with $\Lambda \rightarrow \pi^- p$

2) Misinterpret the p as a nearly coincident π^+ and p pair.

3) assume that the $\pi^+ \pi^-$ pair come from a K_s

The resulting pK_s pair has a fitted M=1.53 GeV.

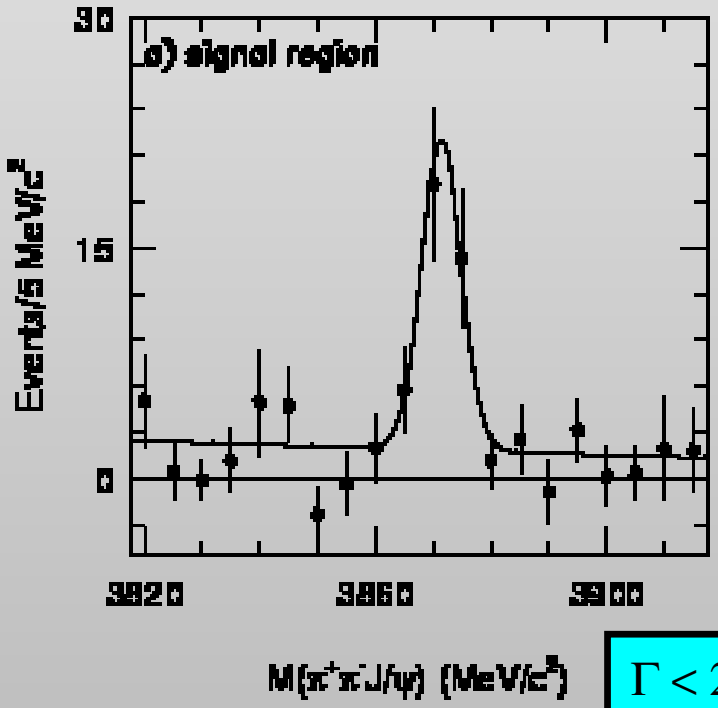
n.b. This (trivially) explains diff. masses for pK_s and nK^+ signals.

Please let’s not forget…

Belle Collab. K.Abe et al, hep-ex/0308029;
S.-K.Choi et al, hep-ex/0309032, PRL91 (2003) 262001.

Confirmed by CDF.

X(3872) from KEK



$B^{+/-} \rightarrow K^{+/-}\ \pi^+\pi^-\ J/\Psi$

$\Gamma < 2.3$ MeV

$M = 3872.0 \pm 0.6 \pm 0.5$ MeV

$M(D^o + \underline{D}^{*o}) = 3871.5 \pm 0.5$ MeV

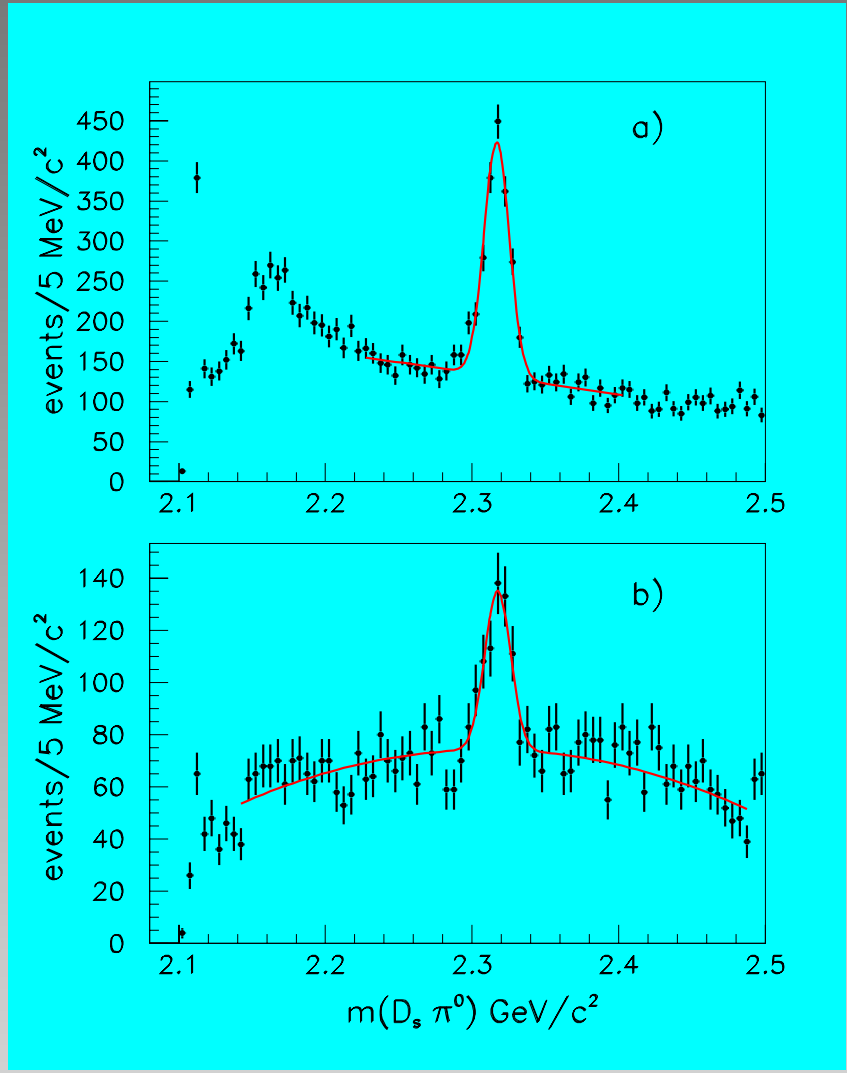
Accidental agreement?
X = $c\underline{c}$ (2^{-+} or 2^{--} or …),
or a molecular (**multiquark**) state?

The $D^*_{sJ}(2317)^+$ in $D_s^+ \pi^0$

D.Aubert et al. (BABAR Collab.), PRL90, 242001 (2003).

M = 2317 MeV (2 D_s channels), Γ < 9 MeV (expt. resolution)

Since confirmed by CLEO, Belle and FOCUS.

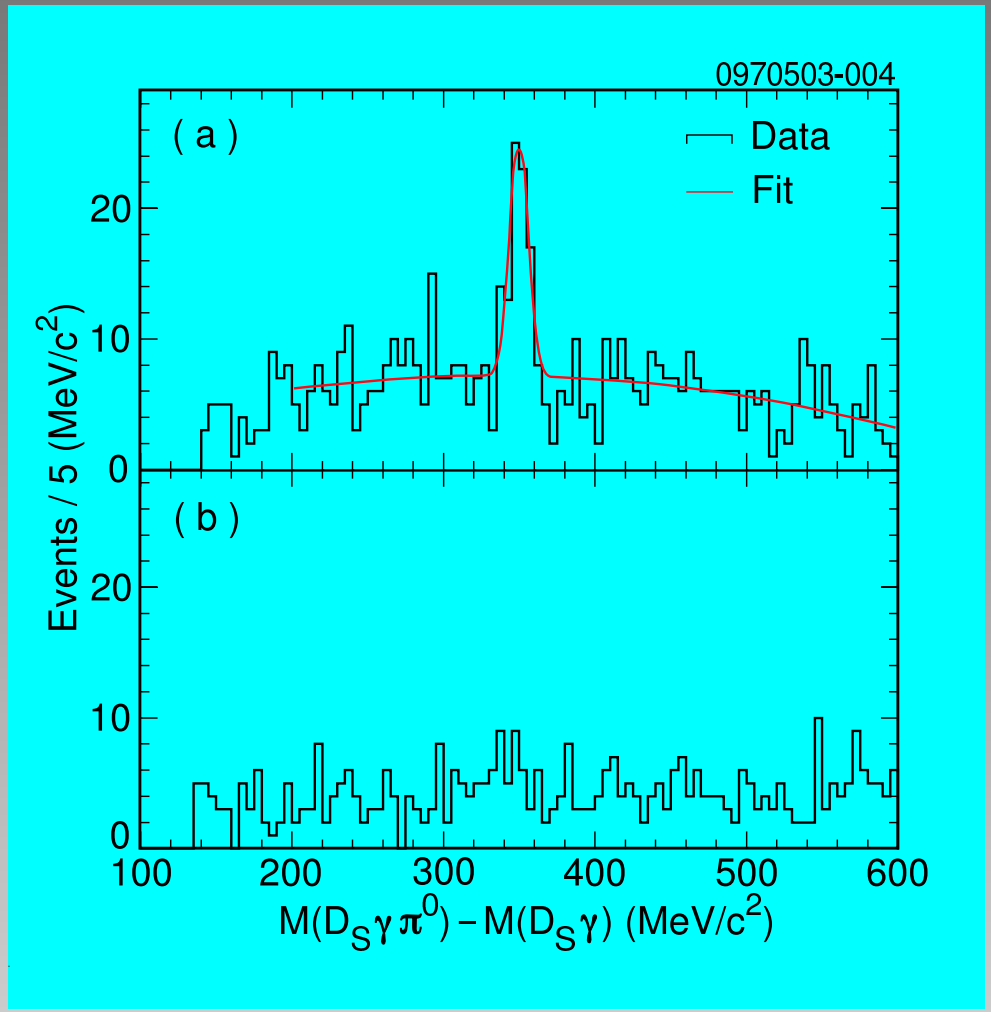


And another! The $D^*_{sJ}(2463)^+$ in $D_s^{*+}\pi^0$

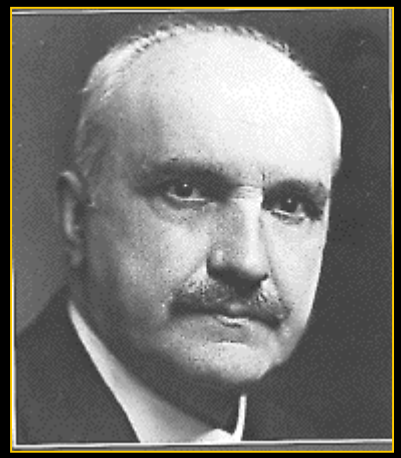
D.Besson et al. (CLEO Collab.), PRD68, 032002 (2003).

M = 2463 MeV,
Γ < 7 MeV (expt. resolution)

Since confirmed by BABAR and Belle.
M = 2457 MeV.



3) Words of wisdom (I). (on being careful)

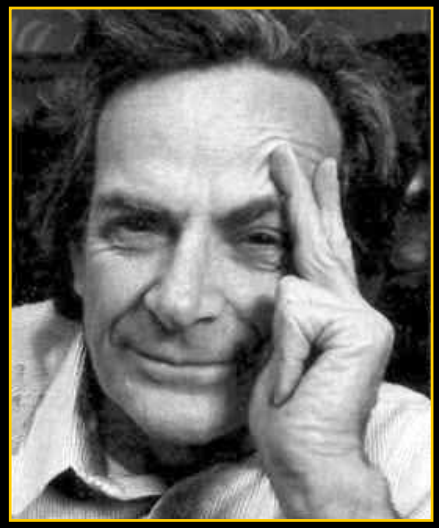


Jorge Agustín Nicolás Ruiz de Santayana (1853-1952)
AB, PhD Harvard (1886,1889). Prof. of Philosophy, Harvard (to 1912).

"Those who cannot remember the past are condemned to repeat it."
Life of Reason, Reason in Common Sense (1905)

"Scepticism is the chastity of the intellect, and it is shameful to surrender it too soon or to the first comer."
Scepticism and Animal Faith (1923)

3) Words of wisdom (II).



Richard P.Feynman (1918-1988)
PhD Princeton (1942),
Prof. of Physics, Caltech
(to 1988).

On "Cargo Cult Science" (1974)

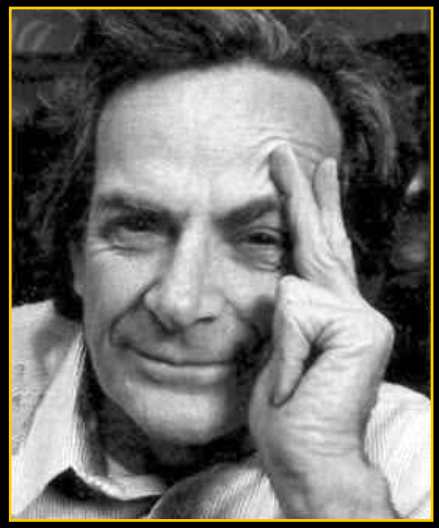
This was mainly about UFOlogists, psychologists, ESPologists, etc. It certainly does not apply to anyone here. However what Feynman had to say is still interesting, some of it consists of useful reminders that we should all keep in mind…

…just good general research habits.

And, some of his points HAVE been encountered in the pentaquark adventure.

"The first principle is that you must not fool yourself – and you are the easiest person to fool."

3) Words of wisdom (II).



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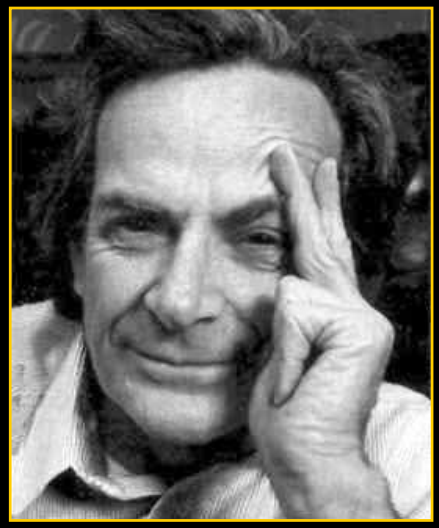
“We've learned from experience that the truth will come out. Other experimenters will repeat your experiment and find out whether you were wrong or right. Nature's phenomena will agree or they'll disagree with your theory.

[…] you will not gain a good reputation as a scientist if you haven't tried to be very careful in this kind of work. And it's this type of integrity, this kind of care not to fool yourself, that is missing to a large extent in much of the research in cargo cult science.”

3) Words of wisdom (II).



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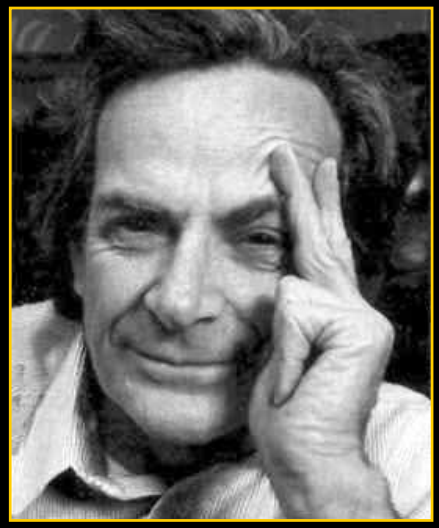
"…there is one feature I notice that is generally missing in cargo cult science…

It's a kind of scientific integrity, a principle of scientific thought that corresponds to a kind of utter honesty -- a kind of leaning over backwards.

For example, if you're doing an experiment, you should report everything that you think might make it invalid -- not only what you think is right about it: other causes that could possibly explain your results; and things you thought of that you've eliminated by some other experiment, and how they worked -- to make sure the other fellow can tell they have been eliminated."

We are scientists, not lawyers.
We should present all sides of a question.

3) Words of wisdom (II).



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"One example of the principle"

[how not to fool yourself]

"is this:

If you've made up your mind to test a theory, or you want to explain some idea, you should always decide to publish it whichever way it comes out. If we only publish results of a certain kind, we can make the argument look good. We must publish BOTH kinds of results."

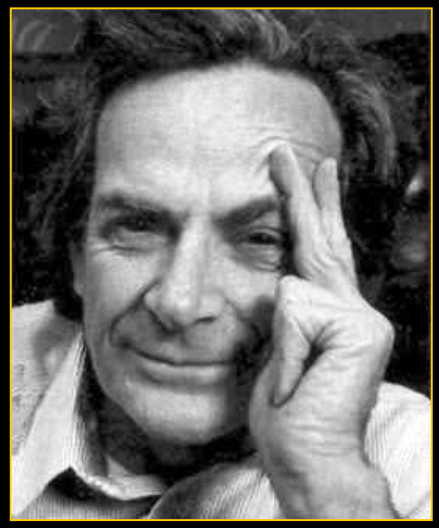
How many pentaquark observations?
(ca. 9-10)

How many pentaquark NONobservations?
(3-12?)

These are much harder to find because
A NONobservation is not news. ???

Wrong. These are at least as interesting as observations.

3) Words of wisdom (II).



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On "Cargo Cult Science"

(conclusion)

"So I have just one wish for you -- the good luck to be somewhere where you are free to maintain the kind of integrity I have described, and where you do not feel forced by a need to maintain your position in the organization, or financial support, or so on, to lose your integrity.

May you have that freedom."

Is it real? May we know before QNP-2006.

The End