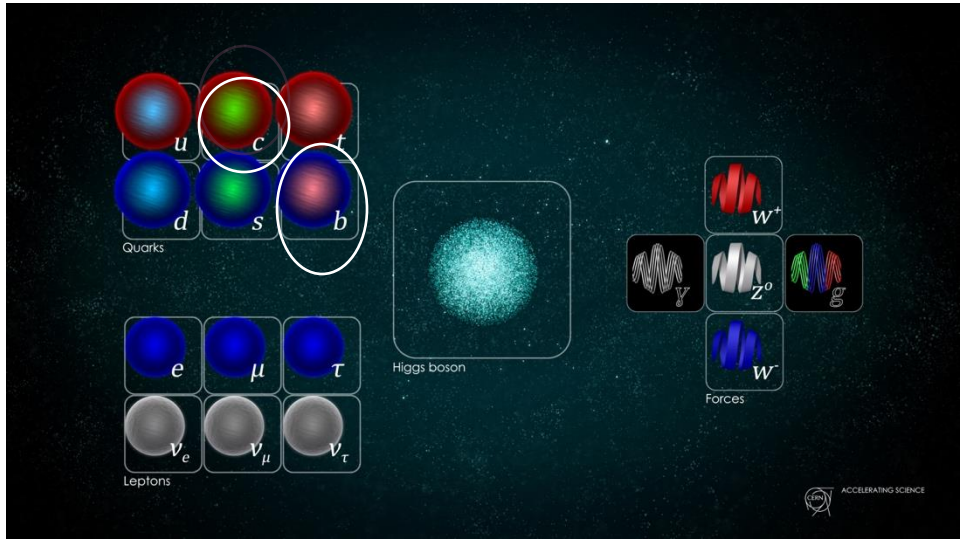
IAN SHIPSEY, A STORY
CHAPTER II - THE CLEO DAYS

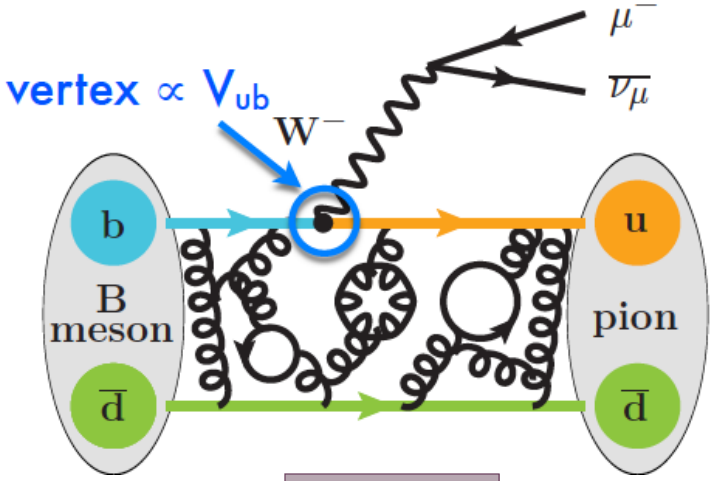
Personal notes by

Marina Artuso, Syracuse University

PREAMBLE – THE WHY AND HOW OF THE WORK THAT I WILL DESCRIBE

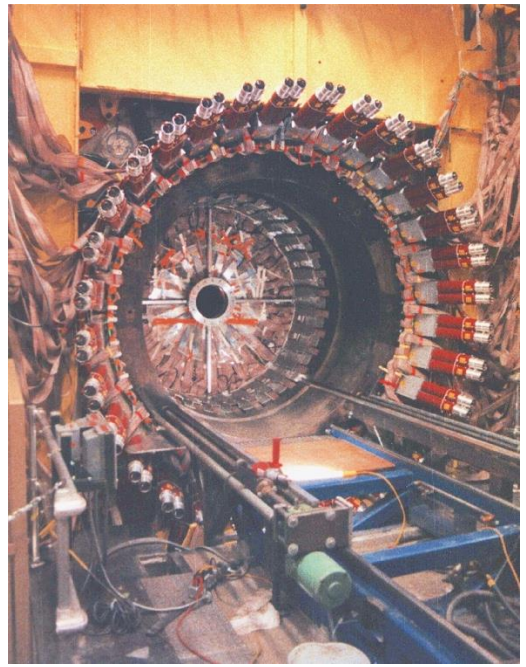
The main characters of our inquiry





What we see is this

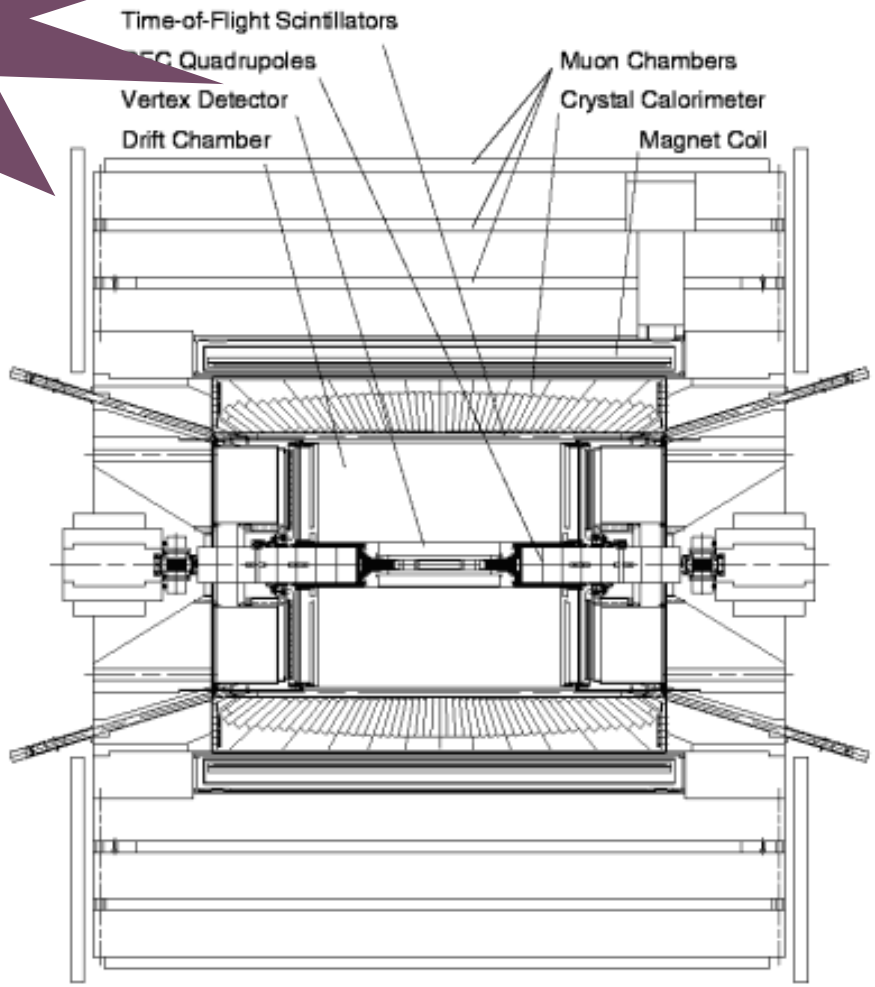
To see we need this



Ian was deeply engaged and became a leader early in his career in the fundamental exploration and in developing the tools to advance it

THE BEGINNING

A time of big dreams: detector work and the pioneering days of flavor physics



- When I met Ian he was a Postdoctoral Research Associate at Syracuse University, where Daniela was pursuing her doctoral work. This was 1988 and the CLEO collaboration was poised to complete the beautiful iteration of its detector known as CLEO II. It featured the first CsI calorimeter, a model for the b-factories to follow.
- The Syracuse team was responsible for the new muon detector for CLEO II and Ian and Daniela were at Cornell to work in the last phases of the installation and commissioning of the detector.
- It was a period when flavor physics was still a vast unexplored territory, we did not yet know whether |Vub| was different than 0, rare decays were a largely unexplored territory, and CP violation in B decays was not yet established.

AN EARLY BRUSH WITH DEATH

- We are here to celebrate the scientific legacy of Ian, however there is a chapter of his personal life that needs to be remembered, for the profound effect that it had in what came afterwards, and because it showed the resilience and grace with which Ian and Daniela face adversities:
- When his career just took a turn towards the next step in his amazing career, with a faculty position at Purdue University, Ian fell ill and to the astonishment of family and friends, it turned out to be an acute myelogenous leukemia. Quoting from Ian:

"At the time, almost nobody survived leukemia," Shipsey said. "But the first time I met my doctor, he came into the room, surrounded by other doctors and students, took me by the hand, and said, 'I will make you well.' And I believed him immediately."

AND ANOTHER ILLUMINATING EXAMPLE ON HOW TO TRANSFORM AN ADVERSITY INTO AN OPPORTUNITY TO CONNECT

Ian was able to beat leukemia, but a harsh antibiotic treatment left him deaf.

This did not stop him from working, teaching, disseminating his scholarly work

After several years he was able to get a cochlear implant and hear again, making this a teachable moment too

A SNAPSHOT OF HIS CLEO II PHYSICS DAYS

The HQET days, and the beauty of baryons

May 16, 1993.
CBX 93 — 51
Ting Miao
Ian Shipsey

A Study of the Decay $\Lambda_c^+ \to X\Lambda\ell^+\nu_\ell$

ABSTRACT

Using the CLEO II detector at CESR we have observed the decay modes $\Lambda_c^+ \to X\Lambda e^+\nu_e$ and $\Lambda_c^+ \to X\Lambda\mu^+\nu_\mu$ by the detection of a final state containing a Λ and a lepton of appropriate sign and invariant mass. From a signal of 500 events we find $B(\Lambda_c^+ \to X\Lambda e^+\nu_e)\cdot\sigma(e^+e^- \to \Lambda_c^+ X) = (4.72^{+0.29}_{-0.28}\ ^{+0.61}_{-0.70})$ pb and $B(\Lambda_c^+ \to X\Lambda\mu^+\nu_\mu)\cdot\sigma(e^+e^- \to \Lambda_c^+ X) = (4.70^{+0.57}_{-0.50}\ ^{+0.60}_{-0.70})$ pb. The combined result is $B(\Lambda_c^+ \to X\Lambda\ell^+\nu_\ell)\cdot\sigma(e^+e^- \to \Lambda_c^+ X) = (4.72 \pm 0.25^{+0.61}_{-0.70})$ pb. As the decay $\Lambda_c^+ \to X\Lambda\ell^+\nu_\ell$ accounts for an unknown fraction, f, of the semileptonic decays of the Λ_c, the charm semileptonic width and the lifetime of the Λ_c predict $B(\Lambda_c^+ \to pK^-\pi^+) = f\ (6.7 \pm 0.4^{+1.4}_{-1.3})\%$, where $(0 < f < 1)$. We measure, for the first time, the decay asymmetry parameter of $\Lambda_c^+ \to \Lambda e^+\nu_e$ to be $\alpha_{\Lambda_c} = -0.89^{+0.22}_{-0.11}$.

CBX 95-21
Mary Bishai
Ting Miao
Ian Shipsey
November 10, 1995

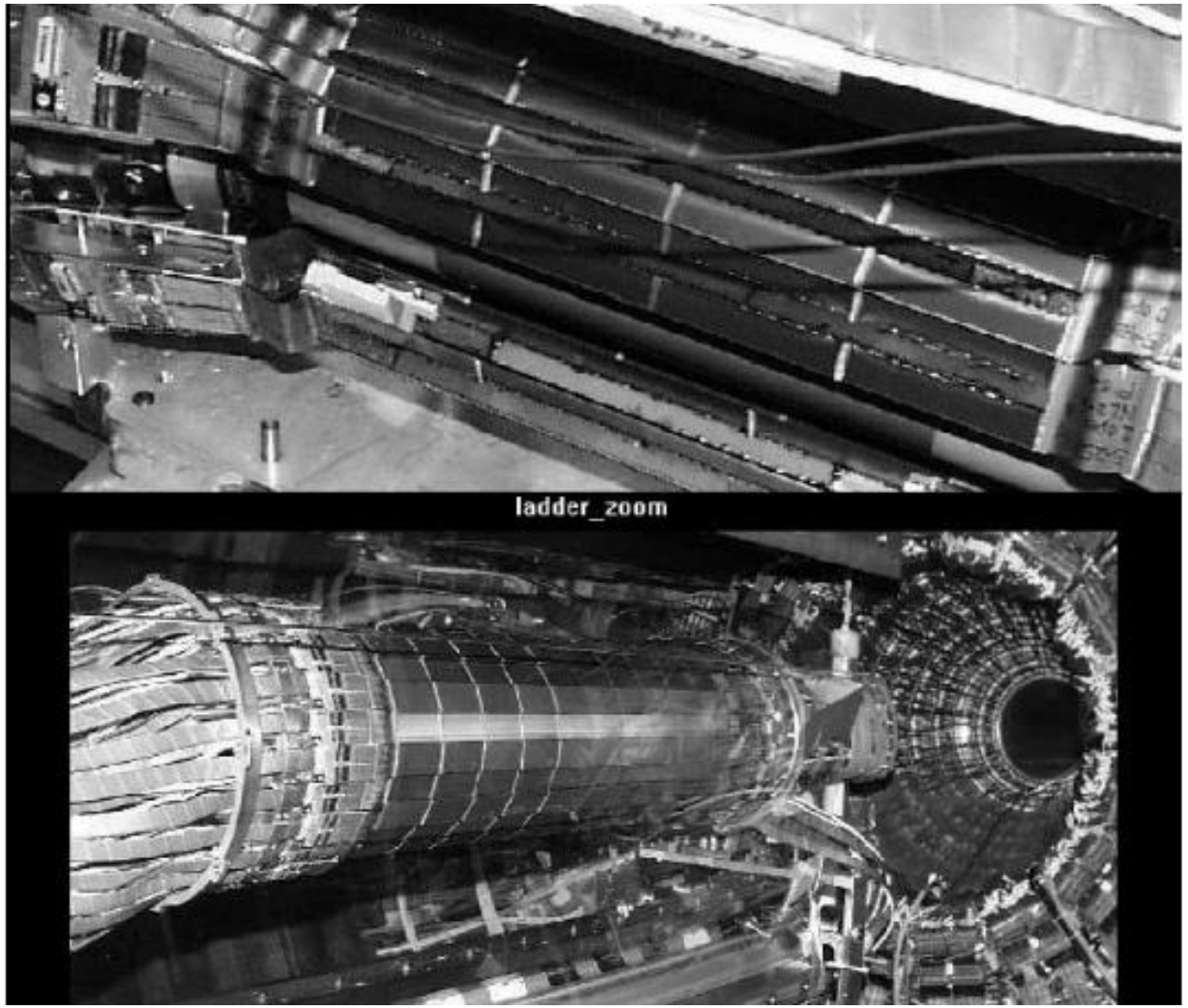
Evidence for $\Omega_c \to \Omega e^+\nu_e$ in e^+e^- Annihilation

Abstract

Using the CLEO II detector at CESR we have obtained 10.4 ± 3.8 events consistent with the decay $\Omega_c \to \Omega e^+\nu_e$ by the detection of a final state containing an Ω and a positron of appropriate sign and invariant mass. We find $B(\Omega_c^0 \to \Omega^- e^+\nu_e)\cdot\sigma(e^+e^- \to \Omega_c^0 X) = 0.22 \pm 0.08$pb.

CLEO III – WORK ON THE CLEO III SILICON DETECTOR

- The last chapter of CLEO as a proto-b-factory experiment was to complement the excellent CsI calorimeter (the first of its kind in CLEO II) with a new Si detector (double-sided Si) and state of the art hadron ID system (CLEO LiF RICH)
- The work on the mechanics and integration of the CLEO III Si launched the fantastic Si laboratory at Purdue University, that established Ian and Daniela as leaders in Si detector design and construction



TESTIMONIALS FROM STUDENTS

From 1992-1999 I worked as a postdoc at Purdue designing and building the CLEO III silicon tracker and searching for rare B meson decays. While my focus on instrumentation was not ideal for launching an academic career at that time, it led to a long an interesting career in the national labs doing a broad range of work - *something I greatly appreciated about Ian's large range of scientific interests.*
Jim Fast

We used Linux talk to chat (thats like messenger without the emoji or pictures for those who weren't yet born then) and communicate especially after I moved to Ithaca to work on CLEO II. Oh Boy was Ian chatty! online and in real life !! ...?). I learnt an important life lesson though - being a great scientist also meant taking care of yourself as a human and enjoying life to the fullest … Mary Bishai

Everything we're doing with Ian is things that have never been done before" Cairo, an undergraduate working with Ian said "He is very smart but very funny, and he never makes you feel dumb or tries to show how smart he is. Working with him is a blast!

BUT THE LUMINOSITY EDGE WAS SLIPPING AWAY FROM CLEO/CESR

What next?

LATTICE QCD MEETS EXPERIMENT

CLEO-C and Lattice QCD

In the words of

Peter Lepage

Cornell University

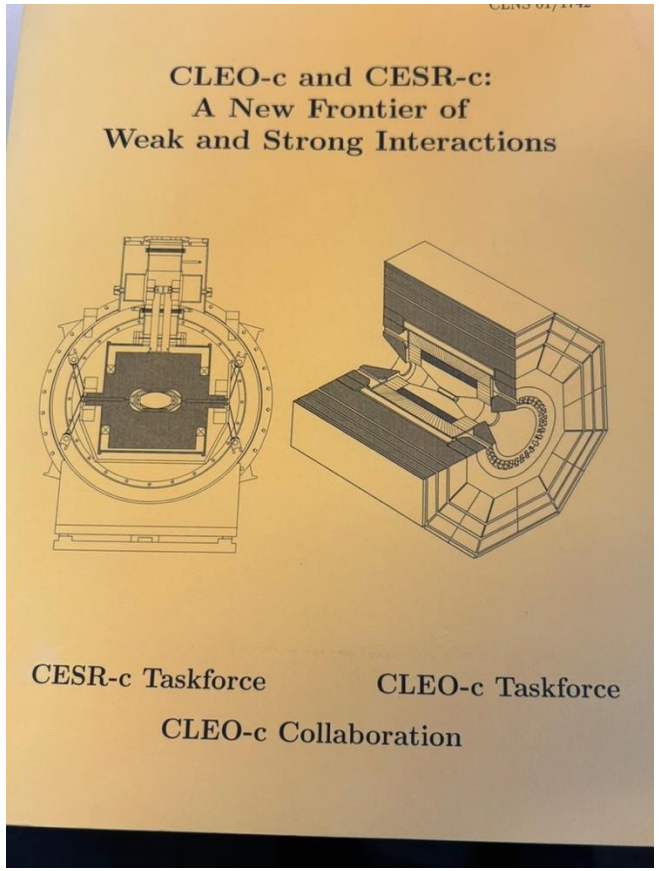
5 May 2001

- History: "Fall and Rise of Lattice QCD"
  - Invented 1974; "explains" confinement.
  - Stalls for almost 20 years.
    - Ken Wilson declares it dead (1989).
  - Renaissance in 1990's:
    - Lattice perturbation theory fixed.
    - Effective field theories for heavy quarks (NRQCD, HQET...).
    - Improved discretizations (and larger lattice spacings).
  - First high-precision nonperturbative results in history of strong interactions:
    - $\alpha_s(M_Z)$ to 2-3%.
    - M_b to 5%.
    - Ken Wilson retracts (circa 1995).
- Current situation (last 5 years):
  - 10-20% accurate results for a wide range of masses, form factors, ... for B's, D's, ψ's, Υ's, π's, K's ...

The outcome: a "predictive QCD challenge"

THE CLEO-C TASK FORCE

A reinvention of a laboratory with a mission: reaching fundamental physics through a deeper understanding of QCD in non-perturbative domain

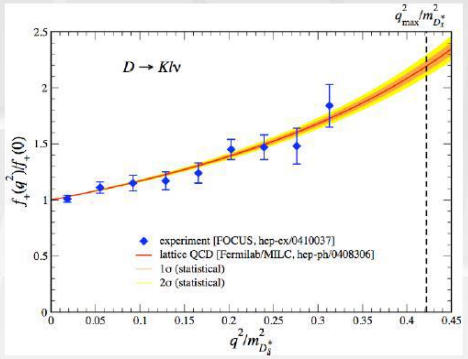


Semileptonic *D* Decays

C. Aubin, C. Bernard, C. DeTar, M. DiPierro, A. El-Khadra, Steven Gottlieb, E.B. Gregory, U.M. Heller, J. Hetrick, A.S. Kronfeld, P.B. Mackenzie, D. Menscher, M. Nobes, M. Okamoto, M.B. Oktay, J. Osborn, J. Simone, R. Sugar, D. Toussaint, H.D. Trottier
(Fermilab Lattice, MILC, and HPQCD Collaborations)
Phys. Rev. Lett. **94**, 011601 (2005) [arXiv:hep-ph/0408306].

When our paper was posted on the arXiv, we knew the normalization of the $D \to \pi l\nu$ and $D \to Kl\nu$ form factors agreed with measurements from the BES Collaboration and the CLEO Collaboration. This agreement had been seen throughout the cycle of conference proceedings and journal publications. So this is almost, but not quite, a *p*rediction.

More spectacularly, two months after our paper was posted on the arXiv, the FOCUS Collaboration finished a measurement of the shape of the $D \to Kl\nu$ form factor. Their data are plotted over our curve (with 1 and $2\sigma_{stat}$ bands) and agree excellently.



Leptonic *D* Decays

C. Aubin, C. Bernard, C. DeTar, M. DiPierro, E. D. Freeland, Steven Gottlieb, U. M. Heller, J. E. Hetrick, A. X. El-Khadra, A. S. Kronfeld, L. Levkova, P. B. Mackenzie, D. Menscher, F. Maresca, M. Nobes, M. Okamoto, D. Renner, J. Simone, R. Sugar, D. Toussaint, H. D. Trottier
(Fermilab Lattice, MILC, and HPQCD Collaborations)
arXiv:hep-lat/0506030 → *Phys. Rev. Lett.*

QCD's influence on the leptonic decay $D_{(s)} \to l\nu$ is parameterized by decay constants f_D and f_{Ds}. Until 2005, the only measurements were based on only a few events and had, hence, uncertainties of 20–60%.

For the 2005 Lepton-Photon Symposium, CLEO-c planned to announce a measurement of f_D with 5–10% uncertainty. The challenge to (lattice) QCD was set.

We took up the challenge, finding [hep-lat/0506030]

$f_{D^+} = 201 \pm 3 \pm 17$ MeV,
$f_{Ds} = 249 \pm 3 \pm 16$ MeV.

Afterwards, CLEO-c showed its new result. With 47 ± 8 events [hep-ex/0508057]

$f_{D^+} = 223 \pm 17 \pm 3$ MeV

At this year's Moriond Winter Conference, the BaBar Collaboration showed a nice measurement of f_{Ds} [http://moriond.in2p3.fr/EW/2006/Transparencies/J.W.Berryhill.pdf]:

$f_{Ds} = 279 \pm 17 \pm 20$ MeV.

Mass of B_c Meson

Ian F. Allison, Christine T.H. Davies, Alan Gray, Andreas S. Kronfeld, Paul B. Mackenzie, James N. Simone
(HPQCD and Fermilab Lattice Collaborations)
Phys. Rev. Lett. **94**, 172001 (2005) [arXiv:hep-lat/0411027].

The B_c meson consists of a bottom quark and a charmed antiquark. It was first observed by CDF during Run I of the Tevatron. The decay mode was $B_c \to J/\psi l\nu$, the neutrino was missed so the mass resolution was ± 400 MeV. DØ confirmed the observation in Run 2, also in semileptonic decay.

From *B Physics at the Tevatron: Run II and Beyond* [hep-ph/0201071], it was clear that nonleptonic modes would be much, much better.

At Lattice 2004, we presented results that were in almost final form. By mid-November, we posted our paper on the arXiv:

$m_{Bc} = 6304 \pm 12\ ^{+18}_{-0}$ MeV.

Later, CDF presented evidence for $B_c \to J/\psi\pi$ decay, reconstructing a mass [hep-ex/0505076]

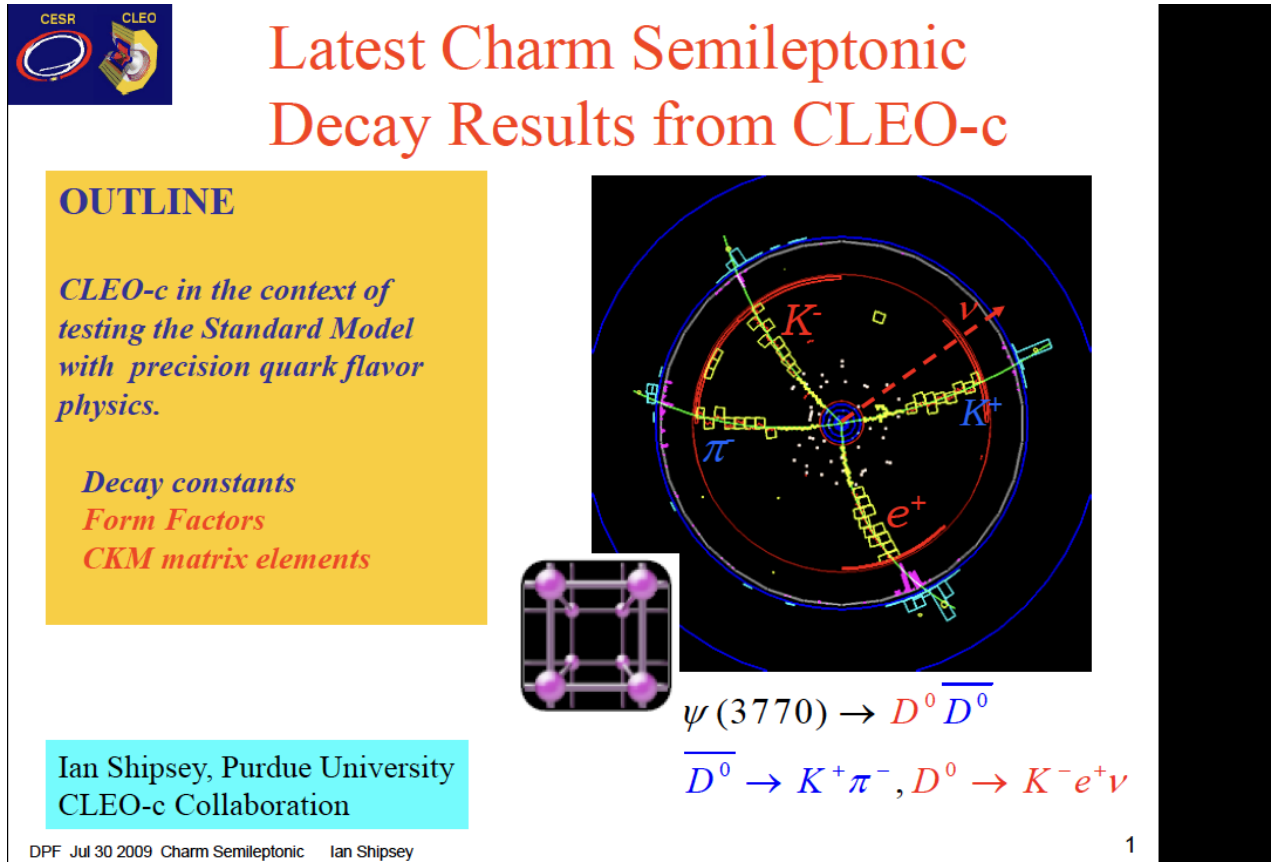
$m_{Bc} = 6287 \pm 5$ MeV.

Our result is based on computing the mass splitting $\Delta_{\psi\Upsilon} = m_{Bc} - (\bar{m}_\psi + m_\Upsilon)/2$, which is astonishingly flat as a function of lattice spacing:

From A. Kronfeld: first two columns were predictions to be validated byt CLEO-c

IAN WAS A CHARISMATIC CLEO-C LEADER

- Ian was an eloquent advocate of CLEO-c, he gave innumerable talks to share his enthusiasm for this new project, he co-led with me the CLEO-c task force and was a beloved spokesperson of CLEO-c (2001-2004).
- His passion was extracting Standard Model parameters from precision studies of semileptonic decays, and he completed several sophisticated analyses in this very important area of inquiry

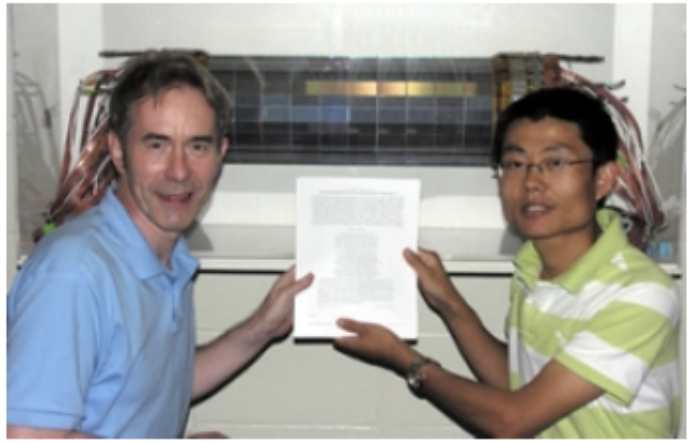


By my count there are 118 CLEO-c publications among the 530 CLEO publications. D. Cassel

Physics Purdue news

CLEO particle physics experiment breaks publication world record

2009-09-22



Particle physicists from around the world who have used the subatomic particle detector, CLEO, to probe the mysteries of the subatomic world are celebrating their 500th academic paper submitted to a peer-reviewed journal. This number of papers, officials say, sets a new world record for a particle physics scientific collaboration.

The 500th paper, titled "Improved Measurements of Semileptonic Decays of D Mesons to Pi and K Mesons," was published in the journal Physical Review D at the end of August, it describes ultra-precise measurements that could shed light on how the matter in stars, galaxies and humans survived the Big Bang. Purdue faculty, post docs and students, are leading members of CLEO. Professor David Miller (1992-95) and professor Ian Shipsey (2001-04) have served as spokespersons of the collaboration. Shipsey and Purdue graduate student Bo Xin, Cornell faculty member Ritchie Patterson and Cornell graduate student Laura Fields were the analysis team that produced the 500th paper.

CONCLUDING REMARKS

"It is not only through our actions that we can give life meaning — insofar as we can answer life's specific questions responsibly — we can fulfill the demands of existence not only as active agents but also as loving human beings: in our loving dedication to the beautiful, the great, the good. Should I perhaps try to explain for you with some hackneyed phrase how and why experiencing beauty can make life meaningful?

Those who experience, not the arts, but nature, may have a similar response, and also those who experience another human being. **Do we not know the feeling that overtakes us when we are in the presence of a particular person and, roughly translates as, *The fact that this person exists in the world at all, this alone makes this world, and a life in it, meaningful*."**

Victor Frankl, Yes to Life, in spite of everything

A LAST WORD

Ian was blessed with intelligence, determination, humor and grace. A blessing that illuminated his life was his wonderful partnership with Daniela. The story of resilience and powerful creative spirit that I have described is infused with the strong intellectual and emotional bond between them.