# Particle Data Group


Now 55 years

**October 2012**


Pages/kg

RPP12: 1525 pages 2.86 kg | 533

RPP10: 1422 pages 2.92 kg | 487

RPP08: 1339 pages 2.3 kg | 580

RPP06: 1231 pages 2.5 kg | 490

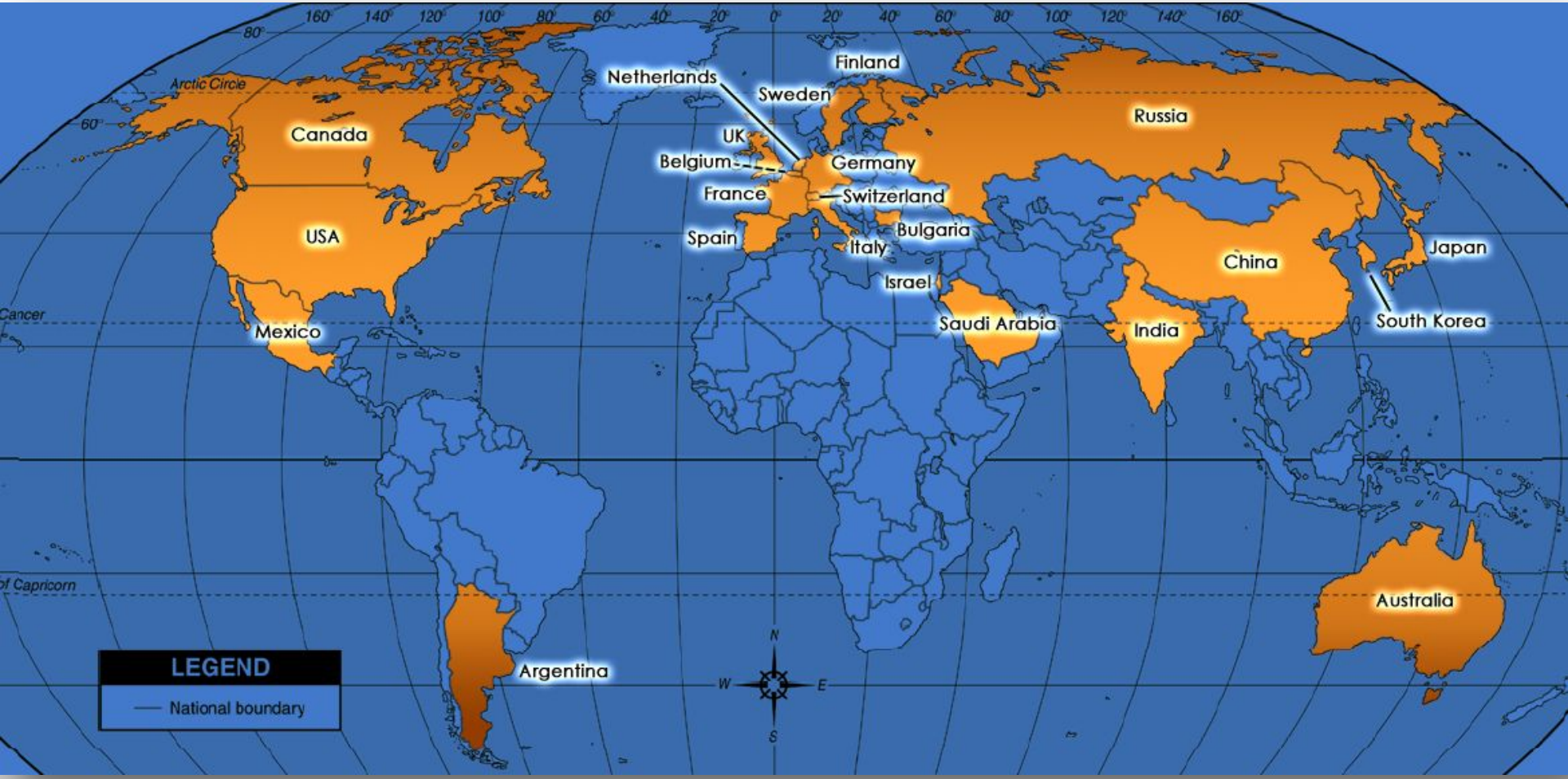
RPP04:1109 pages 1.65 kg | 670

RPP02: 974 pages 1.5 kg | 650

RPP00: 878 pages 1.7 kg | 520

RPP98: 794 pages 1.5 kg | 530

# The PDG Empire



# Collaboration



**Particle Data Group collaboration**

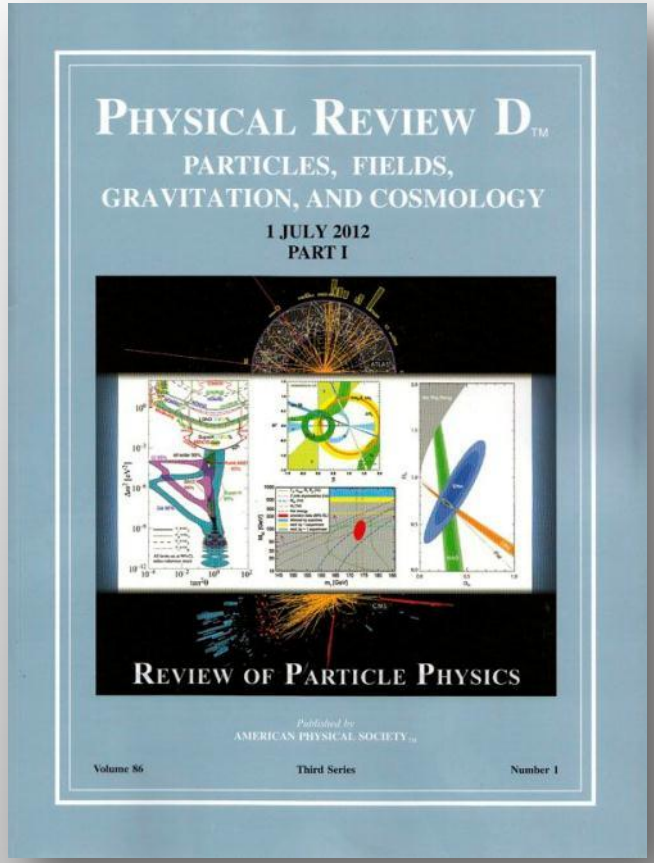
**of 193 authors**

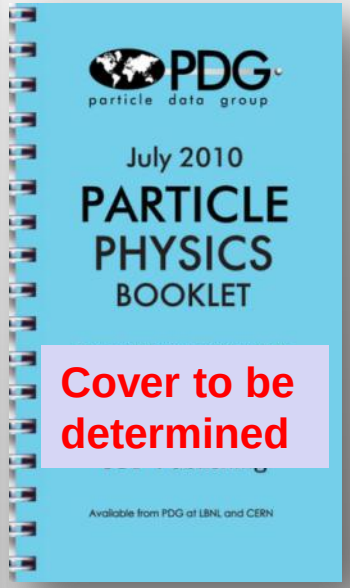
**from 22 countries and 120 institutions**

**+ 700 consultants in the HEP community**

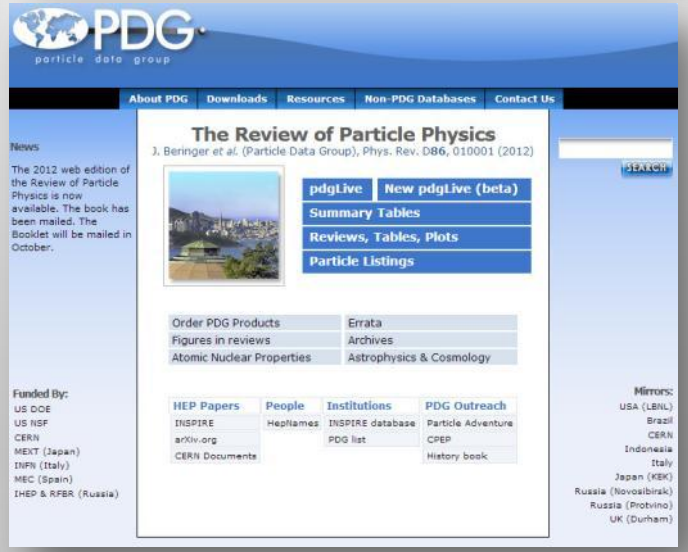
# Review of Particle Physics

- **2012 Edition (book, booklet, web, pdgLive) on schedule**







PDG particle data group

PHYS.ORG

Home | Nanotechnology | Physics | Space & Earth | Electronics | Technology | Chemistry | B

General Physics | Condensed Matter | Optics & Photonics | Superconductivity | Plasma Physics

## Latest edition of the 'Particle Physics Bible' now online

June 19, 2012

***The Review of Particle Physics*, a panorama of the world of high-energy and astroparticle physics, has been compiled and issued every two years since 1957 by the international Particle Data Group, now consisting of almost 200 scientists from 22 countries and based at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab).**

symmetry breaking

A joint Fermilab/SLAC publication

## New "particle physics Bible" released

June 19, 2012 | 10:10 am

Every two years, the international Particle Data Group, consisting of almost 200 scientists from 22 countries and based at Berkeley Lab, releases a new edition of *The Review of Particle Physics*. The 2012 edition, which runs over 1,400 pages long, was released online today.

PDG particle data group

Often referred to as "the Bible of particle physics," the publication compiles and summarizes published results related to particles and their interactions. It may sound a bit dry, but the book is incredibly useful—and ever-present in the lives of particle physicists and astrophysicists the world over.

This year's edition includes 2,658 new measurements from 644 papers, covering every subject of importance in both particle physics and cosmology—including the latest data on Higgs bosons, supersymmetry, *B* mesons, neutrinos, dark matter and more.

In total, the PDG's print editions have been cited in journals more than 41,000 times.

For more on *The Review of Particle Physics* and the Particle Data Group, see the Berkeley Lab announcement.

The Business Journals Digital Network: | The Business Journals | Local Business Directory | Book of Lists | Upstart Business Journ

SAN FRANCISCO Business Times

Choose a city | Home | News | People | Events | Exclusives | How-To | Buy | Find

Blogs | Premium | Companies | Industries | Photo Galleries | Press Releases | My News

BAY AREA | BizTalk

Share | Tweet | Like 9 | Email | Print | Reprints | Comments

## Berkeley Lab publishes 'Particle Physics Bible'

San Francisco Business Times by Steven E.F. Brown, Web Editor
Date: Tuesday, June 19, 2012, 11:41am PDT - Last Modified: Tuesday, June 19, 2012, 3:05pm PDT

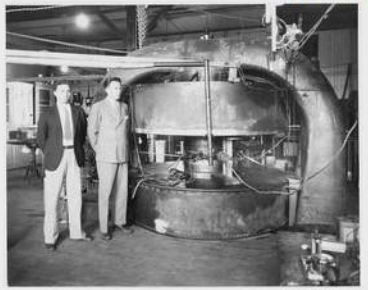
**Steven E.F. Brown**
Web Editor- *San Francisco Business Times*
Email

Have physicists found that elusive Higgs boson yet? Last I heard, they were confident of finding it around 125 gigaelectronvolts.

Well, if you haven't been keeping up on the latest work at the Large Hadron Collider, that 17 mile long particle accelerator buried under France and Switzerland, help is at hand in the form of the "Bible of particle physics," just published by Lawrence Berkeley National Laboratory .

The lab's Particle Data Group, made up of 200 scientists from 22 countries, has published the 1,422 page book known formally as the *Review of Particle Physics*. It

Enlarge Image



Ernest Orlando Lawrence (right) in 1934 with his cyclotron at Berkeley's Radiation Lab. He couldn't look up all those equations online, but thanks to his successors at the lab, you can!

# Highlights in Listings

**644 new papers with 2658 new measurements.**

**Total number of LHC papers: 41 ATLAS, 47 CMS and 18 LHCb papers.**

**LHC data exclude the Standard Model Higgs boson for substantial mass ranges.**

**Major exclusions in SUSY results from the LHC.**

**Latest from B-meson physics: 120 papers with 555 measurements, including first LHCb results. Stringent limits on $B_s \rightarrow \mu\mu$ from LHCb and CMS approaching the SM expectation.**

**Updated and new results in neutrino mixing, including observation of mixing angle $\theta_{13}$ from reactor experiments.**

**63 new top results since 2010, many from LHC experiments.**

**New CDF/D0 value of W-mass with very small error, impact on prediction of Higgs mass.**

**New $\eta_c(1S)$ branching ratio fit removing circular dependencies**

**First observations of $h_b(1P)$, $h_b(2P)$, and the $\chi_b(3P)$ triplet, as well as two exotic charged states with bottomonium content (unconfirmed)**

# Highlights in Reviews (1)



**112 reviews (most are revised or new).**

**New reviews on:**

- **Heavy-Quark and Soft-Collinear Effective Theory**
- **Neutrino Cross Section measurements**
- **Neutrino Beam Lines at High-Energy Proton Synchrotrons**
- **Monte Carlo Event Generators**
- **Lattice QCD**
- **Scalar Meson and σ(500) parameters**
- **Heavy quarkonium spectroscopy**

# Highlights in Reviews (2)

**112 reviews (most are revised or new).**

**Significant update/revision to reviews on:**

- **Astrophysical Constants (extended to include more cosmological parameters from the 7-year WMAP analysis)**
- **Dark Matter**
- **Top Quark with detailed coverage of LHC results**
- **$V_{cb}$, and $V_{ub}$ CKM elements**
- **Quantum Chromodynamics**
- **High-Energy Collider Parameters (includes CLIC and latest LHC parameters)**
- **Particle Detectors for Non-Accel. Physics (addition of Coherent Radio Cherenkov Detectors)**

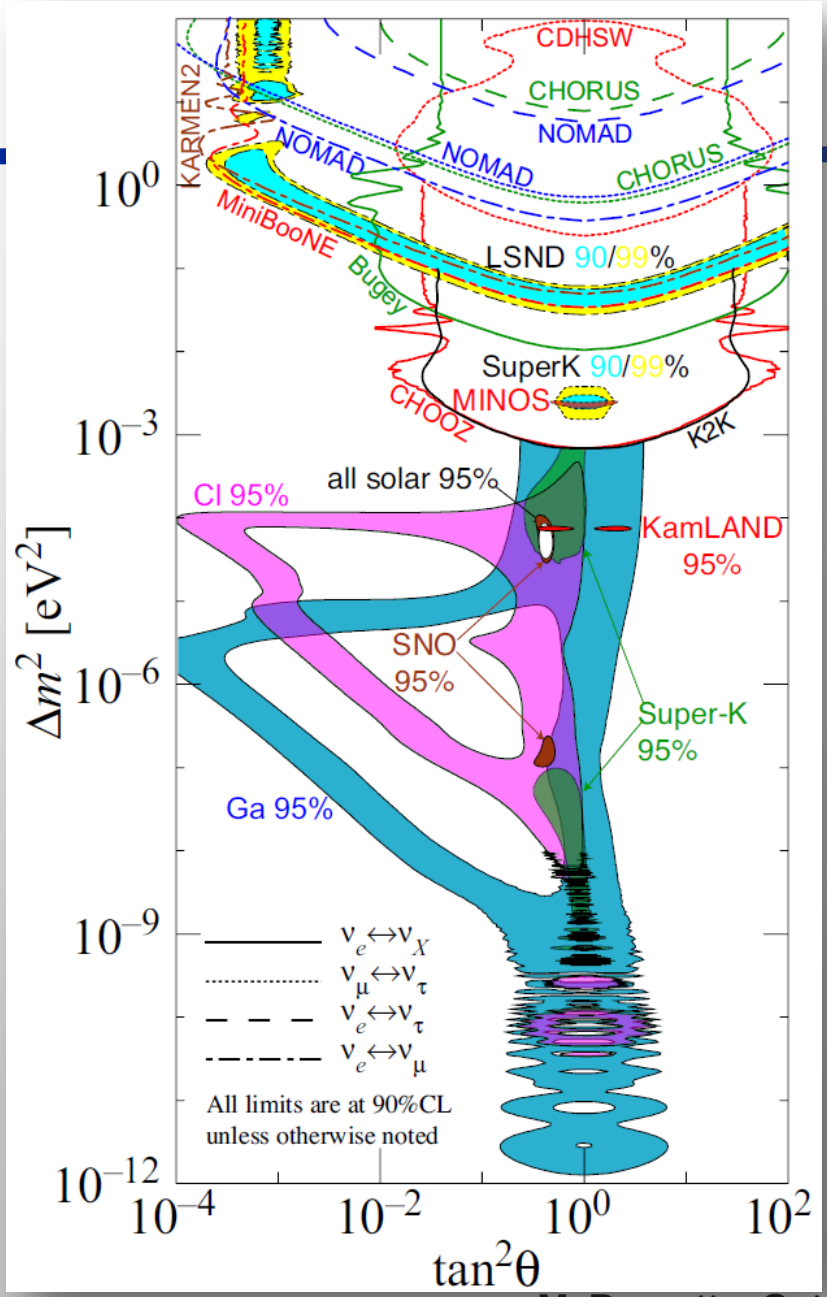
**Astrophysics sections updated with the 7-year WMAP analysis.**

**New heavy quarkonium hadronic transitions diagrams**

**Improved CPT invariance limit: $m_{K^0} - m_{K^0\text{bar}} < 3\times10^{-19}$ GeV at 90% CL**

# A Highlight

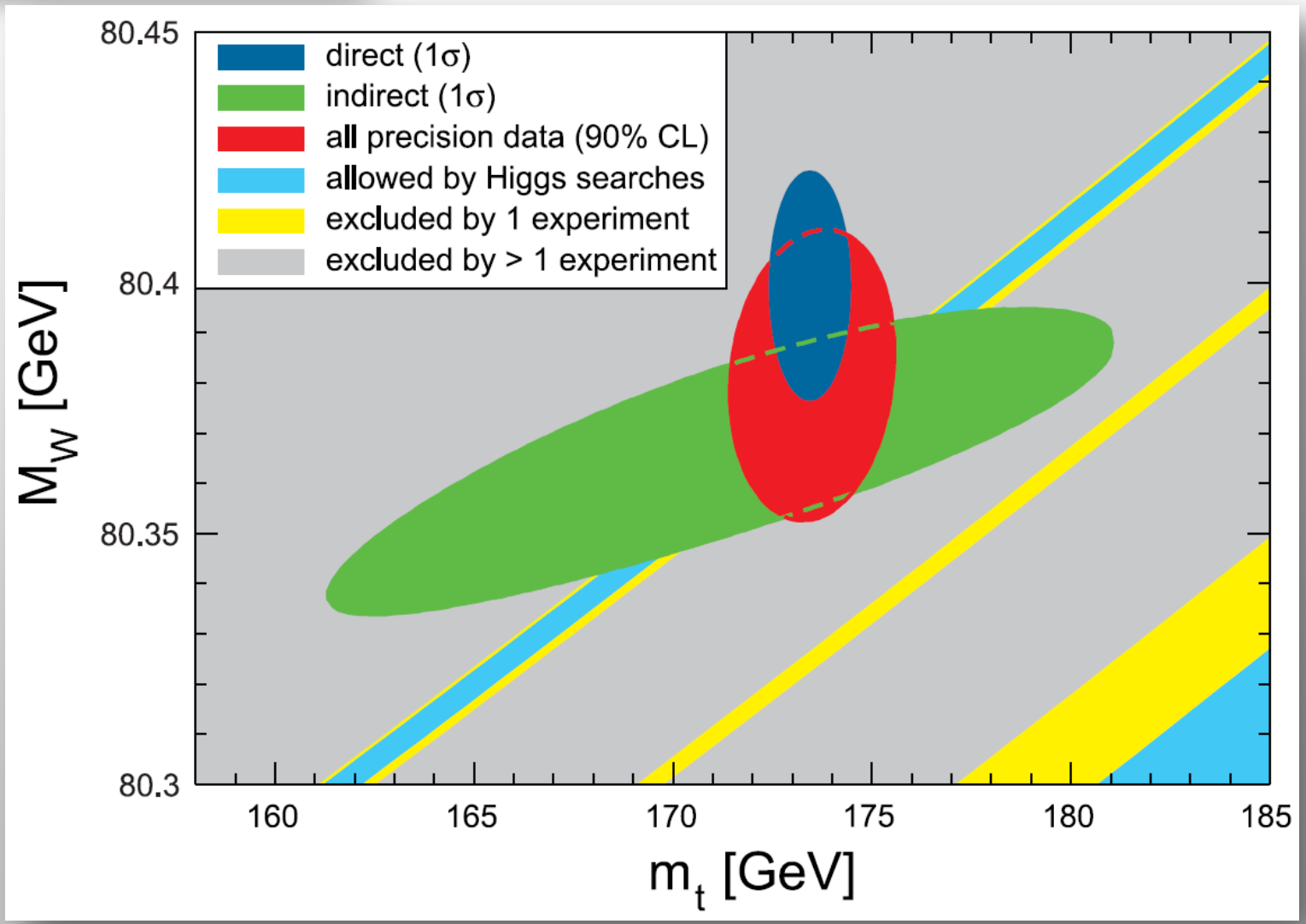
**Latest plot shows large mixing of neutrinos**




**Hitoshi Murayama**

# Electroweak fit

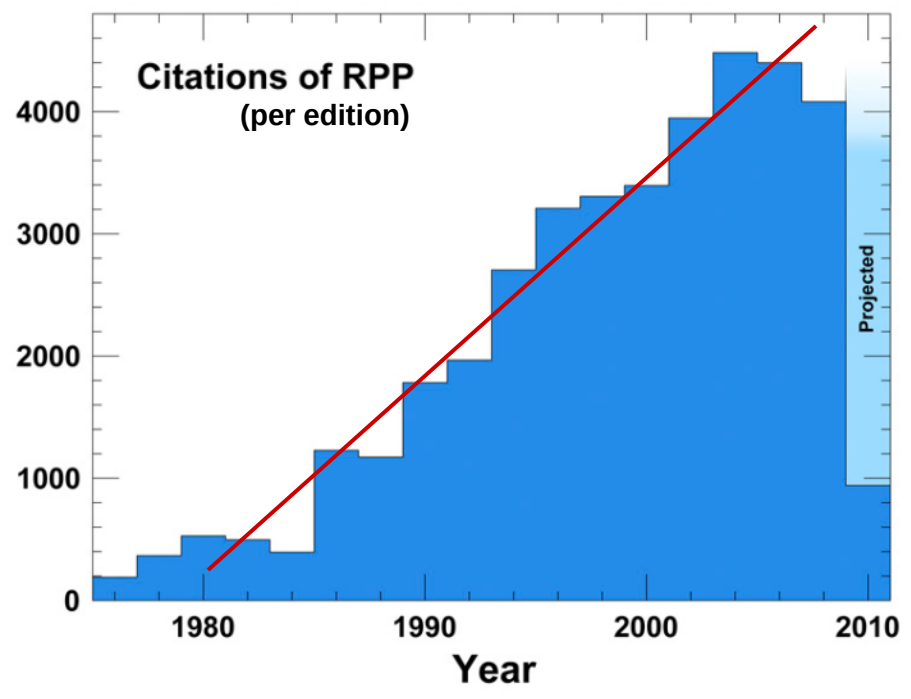




# Top Cited

**The Review is the all-time top cited article in High Energy Physics with more than 41,000 citations (INSPIRE)**

2nd is Weinberg's Standard Model paper with 7727

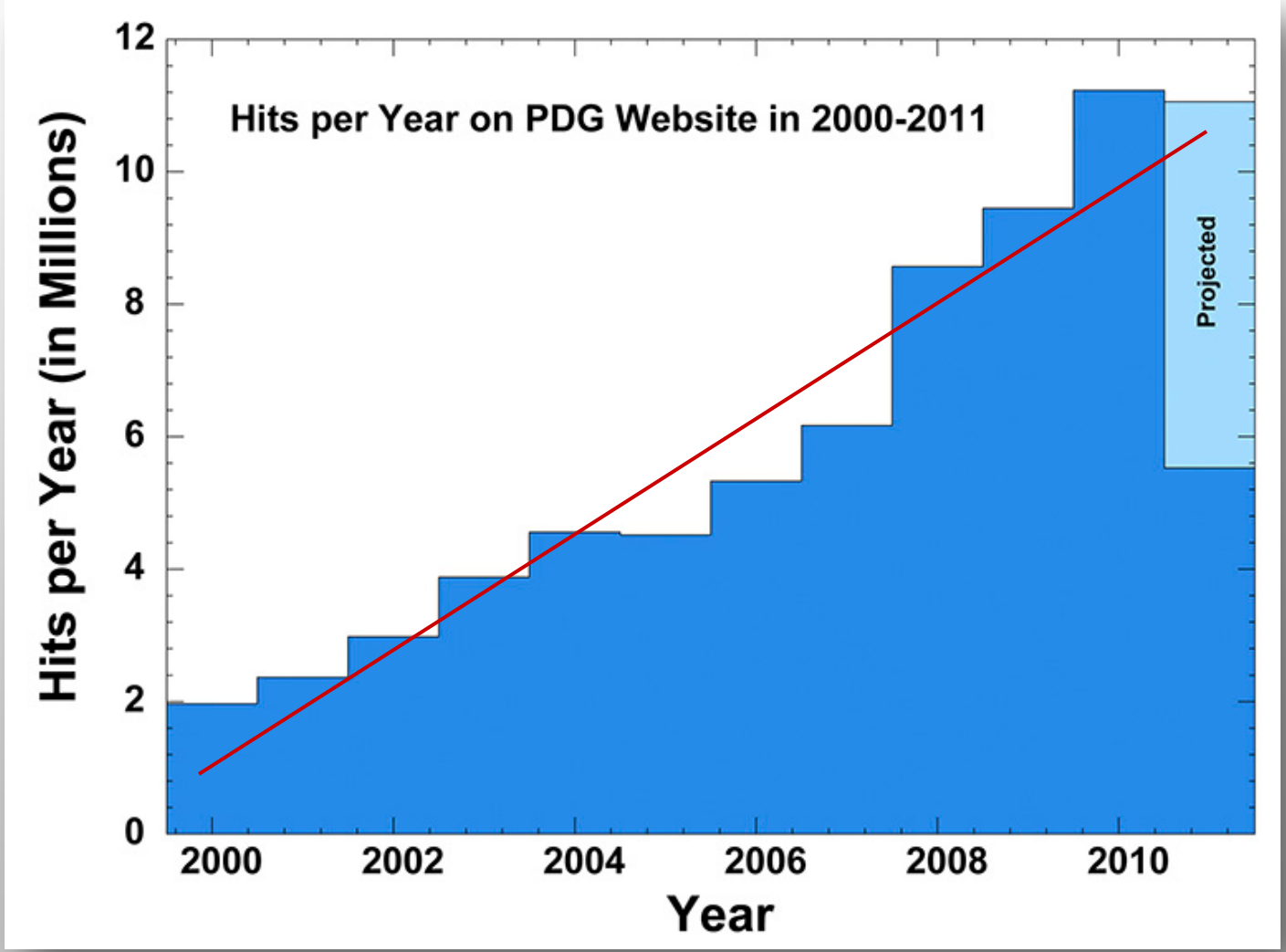



★ Citations increase for years after an edition is published

# Increasing Usage



Excluding mirror sites and excluding education webpages



# PDG Products

- *Review of Particle Physics*
  - 15,000 copies of 1526-page book
- *Particle Physics Booklet*
  - 31,000 copies of 320-page booklet
- *Pocket Diary for Physicists*
  - 17,000 copies

# 2012 Edition of *Review*



- **2658 new measurements from 644 new papers**
  (of total 32,100 measurements and 8900 papers).

- **112 reviews with many exciting and new features**

- **Important new data in areas such as**
  **Higgs, SUSY, neutrinos, top quark, B physics, etc.**

★ Color Figures everywhere

# Listings and Reviews



**The Web allows us to see what most interest our readers.**

**The hits (page views) on**

**Data Listings = Reviews**

**almost exactly equal.**

**Clearly people care about both.**

# Astrophysics & Cosmology

**12 years ago:** Very little

**Now:**

Astrophysical Constants
Big Bang Cosmology
Cosmological Parameters:
$H_0$, $\Lambda$, $\Omega$, etc.
Experimental Tests of Gravitational Theory
Dark Matter
Cosmic Background Radiation
Cosmic Rays

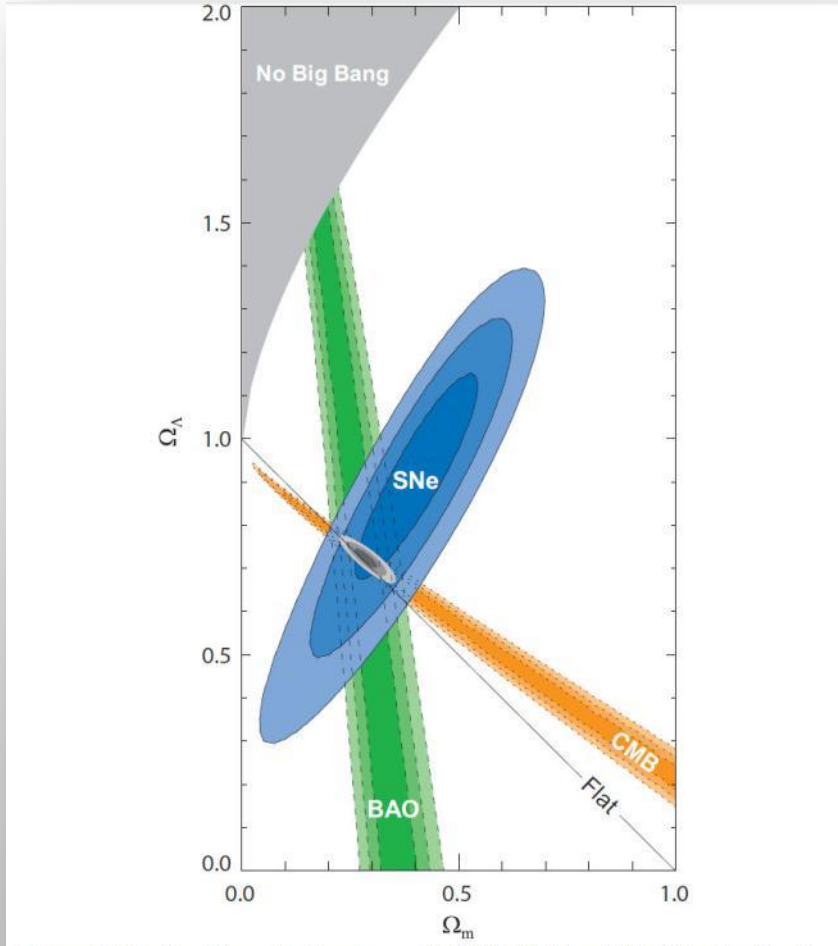



**Figure 23.1:** Confidence level contours of 68.3%, 95.4% and 99.7% in the $\Omega_\Lambda$–$\Omega_m$ plane from the CMB, BAOs and the Union SNe Ia set, as well as their combination (assuming $w = -1$). [Courtesy of Kowalski *et al.* [25]]

# B Meson Section 1984

Entire section was <u>one</u> page

$B^{\pm}$, $B^0$, B

$B^{\pm}$

41 CHARGED B(5271, JP= ) I=

SEE ALSO THE LISTING FOR THE B (FOLLOWING THE ENTRY FOR THE NEUTRAL B) FOR MEASUREMENTS WHICH DO NOT IDENTIFY THE CHARGE STATE.

41 CHARGED B MASS (MEV)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| M | A | 6 | 5270.8 | 3.0 | BEHRENDS 83 CLEO +- D*- PI+ PI+ + CC | | 4/83* |
| M | A | STATISTICAL (2.3 MEV) AND SYSTEMATICAL (2.0 MEV) ERRORS COMBINED. | | | | | 4/83* |

41 CHARGED B PARTIAL DECAY MODES

| | | DECAY MASSES |
|---|---|---|
| P1 | B+ INTO DOBAR PI+ | 1865+ 140 |
| P2 | B+ INTO D*(2010)- PI+ PI+ | 2007+ 140+ 140 |

B- MODES ARE CHARGE CONJUGATES OF THE ABOVE MODES.

41 CHARGED B BRANCHING RATIOS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R1 | B+ INTO DOBAR PI+ | | | | (P1) | | |
| R1 | 2 | 0.042 | 0.042 | BEHRENDS | 83 CLEO +- E+ E-, UPSIL(4S) | | 4/83* |
| R2 | B+ INTO D*(2010)- PI+ PI+ | | | | (P2) | | |
| R2 | 6 | 0.048 | 0.030 | BEHRENDS | 83 CLEO +- E+ E-, UPSIL(4S) | | 4/83* |

REFERENCES FOR CHARGED B

BEHRENDS 83 PRL 50 881 + (ROCH+RUTG+SYRA+VAND+CORN+ITHA+HARV+OSU)

$B^0$

42 NEUTRAL B(5274, JP= ) I=

SEE ALSO THE LISTING FOR THE B (FOLLOWING THIS ENTRY) FOR MEASUREMENTS WHICH DO NOT IDENTIFY THE CHARGE STATE.

42 NEUTRAL B MASS (MEV)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| M | A | 5 | 5274.2 | 2.8 | BEHRENDS 83 CLEO 0 D*- PI+ + CC | | 4/83* |
| M | A | STATISTICAL (1.9 MEV) AND SYSTEMATICAL (2.0 MEV) ERRORS COMBINED. | | | | | 4/83* |

42 (B0) - (B+) MASS DIFFERENCE (MEV)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DM | A | | 3.4 | 3.6 | BEHRENDS 83 CLEO E+E-, UPSIL(4S) | | 3/84* |
| DM | A | STATISTICAL (3.0) AND SYSTEMATICAL (2.0) ERRORS COMBINED. | | | | | 3/84* |

39 B PARTIAL DECAY M

| | |
|---|---|
| P1 | B INTO ELECTRON NEUTRINO HADRONS |
| P2 | B INTO MUON NEUTRINO HADRONS |
| P3 | B INTO E+ E- ANYTHING |
| P4 | B INTO MU+ MU- ANYTHING |
| P5 | B INTO KAON ANYTHING |
| P6 | B INTO J/PSI ANYTHING |
| P7 | B INTO D0 ANYTHING |
| P8 | B INTO PROTON ANYTHING |
| P9 | B INTO LAMBDA ANYTHING |

39 B BRANCHING RATIO

| | | | | | |
|---|---|---|---|---|---|
| R1 | | B INTO (ELECTRON NEUTRINO HADRONS) | | | |
| R1 | A | (0.13) | (0.042) | | BEB |
| R1 | B | (0.136) | (0.039) | | SPE |
| R1 | C | 0.127 | 0.021 | | CHA |
| R1 | D | 0.132 | 0.016 | | KLO |
| R1 | E | (0.116) | (0.027) | | NEL |
| R1 | A | THE STATISTICAL AND SYSTEMATIC ER | | | |
| R1 | B | THE STATISTICAL AND SYSTEMATIC ER | | | |
| R1 | AB | THE ELECTRON ENERGY SPECTRA IN BO | | | |
| R1 | AB | B-TO-C OVER B-TO-U QUARK TRANSITI | | | |
| R1 | C | THE STATISTICAL AND SYSTEMATIC ER | | | |
| R1 | D | STATISTICAL AND SYSTEMATIC ERRORS | | | |
| R1 | D | RATIO CS(B-->E NU UP)/CS(B-->E NU | | | |
| R1 | E | THE STATISTICAL AND SYSTEMATIC ER | | | |
| R1 | | ONLY THE EXPERIMENTS AT THE UPSIL | | | |
| R1 | AVG | 0.130 | 0.013 | AVERAGE | |
| R2 | | B INTO (MUON NEUTRINO HADRONS)/TOT | | | |
| R2 | | (0.094) | (0.036) | | CHA |
| R2 | A | (0.105) | (0.020) | | ADE |
| R2 | B | 0.124 | 0.035 | | CHA |
| R2 | | (0.155) | (0.054) | (0.029) | FER |
| R2 | | (0.117) | (0.028) | | ALT |
| R2 | A | THE STATISTICAL AND SYSTEMATIC ER | | | |
| R2 | B | THE STATISTICAL AND SYSTEMATIC ER | | | |
| R2 | | THE AVERAGE OF THE THREE HIGH-ENE | | | |
| R2 | | THESE EXPERIMENTS PRODUCE OTHER B | | | |
| R2 | | THE B MESON. | | | |
| R3 | | B INTO (E+ E- ANYTHING)/TOTAL | | | |
| R3 | | (0.05) OR LESS CL=.90 | | | BEB |
| R4 | | B INTO (MU+ MU- ANYTHING)/TOTAL | | | |
| R4 | | (0.017)OR LESS CL=.90 | | | CHA |
| R4 | | 0.007 OR LESS CL=.95 | | | ADE |
| R4 | | 0.007 OR LESS CL=.95 | | | BAR |
| R4 | | (0.02) OR LESS CL=.95 | | | ALT |
| R5 | | B INTO (DILEPTON ANYTHING) | | | |

# B Meson Section 2012

**Section is 183 pages.**

**In 2008 was 144 pages**

## BOTTOM, CHARMED MESONS ($B = C = \pm 1$)

$B_c^+ = c\bar{b}$, $B_c^- = \bar{c}b$, similarly for $B_c^*$'s

### $B_c^\pm$

$I(J^P) = 0(0^-)$
$I$, $J$, $P$ need confirmation.

Quantum numbers shown are quark-model predictions.

### $B_c^\pm$ MASS

| VALUE (GeV) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **6.277 ±0.006 OUR AVERAGE** | Error includes scale factor of 1.6. | | | |
| 6.2756 ±0.0029 ±0.0025 | [1] AALTONEN | 08M | CDF | $p\bar{p}$ at 1.96 TeV |
| 6.300 ±0.014 ±0.005 | [1] ABAZOV | 08T | D0 | $p\bar{p}$ at 1.96 TeV |
| 6.4 ±0.39 ±0.13 | [2] ABE | 98M | CDF | $p\bar{p}$ at 1.8 TeV |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 6.2857 ±0.0053 ±0.0012 | [1] ABULENCIA | 06C | CDF | Repl. by AALTONEN 08M |
| 6.32 ±0.06 | [3] ACKERSTAFF | 98O | OPAL | $e^+e^- \to Z$ |

[1] Measured using a fully reconstructed decay mode of $B_c \to J/\psi\pi$.

[2] ABE 98M observed $20.4^{+6.2}_{-5.5}$ events in the $B_c^+ \to J/\psi(1s)\ell\nu_\ell$ with a significance of $> 4.8$ standard deviations. The mass value is estimated from $m(J/\psi(1S)\ell)$.

[3] ACKERSTAFF 98O observed 2 candidate events in the $B_c \to J/\psi(1S)\pi^+$ channel with an estimated background of $0.63 \pm 0.20$ events.

### $B_c^\pm$ MEAN LIFE

"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at http://www.slac.stanford.edu/xorg/hfag/. The averaging/rescaling procedure takes into account correlations between the measurements.

| VALUE ($10^{-12}$ s) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.453±0.041 OUR EVALUATION** | | | | |
| **0.45 ±0.04 OUR AVERAGE** | | | | |
| $0.448^{+0.038}_{-0.036} \pm 0.032$ | [4] ABAZOV | 09H | D0 | $p\bar{p}$ at 1.96 TeV |

[6] ABE 98M result is derived from the measurement $[\sigma(B^+) \times B(B^+ \to J/\psi(1S)K^+)] = 0.132^{+0.0}_{-0.0}$ by using PDG 98 values of $B(b \to B^+)$ and $B(B$

[7] ACKERSTAFF 98O reports $B(Z \to B_c X)/B(Z$ $6.95 \times 10^{-5}$ at 90%CL. We rescale to our PDG

[8] ABREU 97E value listed is for an assumed $\tau_{B_c} =$ $\tau_{B_c} = 1.4$ ps.

[9] BARATE 97H reports $B(Z \to B_c X)/B(Z \to q\bar{q})$ at 90%CL. We rescale to our PDG 96 values of B( candidate event is found, compared to all the k which gives $m_{B_c} = 5.96^{+0.25}_{-0.19}$ GeV and $\tau_{B_c} =$

### $\Gamma(J/\psi(1S)\pi^+)/\Gamma_{\text{total}} \times B(\bar{b} \to B_c)$

| VALUE | CL% | DOCUMENT ID |
|---|---|---|
| **$< 8.2 \times 10^{-5}$** | 90 | [10] BARATE |
| • • • We do not use the following data for averages, | | |
| $< 2.4 \times 10^{-4}$ | 90 | [11] ACKERSTAFF |
| $< 3.4 \times 10^{-4}$ | 90 | [12] ABREU |
| $< 2.0 \times 10^{-5}$ | 95 | [13] ABE |

[10] BARATE 97H reports $B(Z \to B_c X)/B(Z \to q\bar{q}$ at 90%CL. We rescale to our PDG 96 values of B

[11] ACKERSTAFF 98O reports $B(Z \to B_c X)/B(Z$ $1.06 \times 10^{-4}$ at 90%CL. We rescale to our PDG

[12] ABREU 97E value listed is for an assumed $\tau_{B_c} =$ $\tau_{B_c} = 1.4$ ps.

[13] ABE 96R reports $B(b \to B_c X)/B(b \to B^+ X$ $J/\psi(1S)K^+) < 0.053$ at 95%CL for $\tau_{B_c} = 0.8$ 0.17 ps$< \tau_{B_c} <$ 1.6 ps. We rescale to our PDG 96 and $B(B^+ \to J/\psi(1S)K^+) = 0.00101 \pm 0.000$

### $\Gamma(J/\psi(1S)\pi^+\pi^+\pi^-)/\Gamma_{\text{total}} \times B(\bar{b} \to B_c)$

| VALUE | CL% | DOCUMENT ID |
|---|---|---|
| **$< 5.7 \times 10^{-4}$** | 90 | [14] ABREU |

[14] ABREU 97E value listed is independent of 0.4 ps<

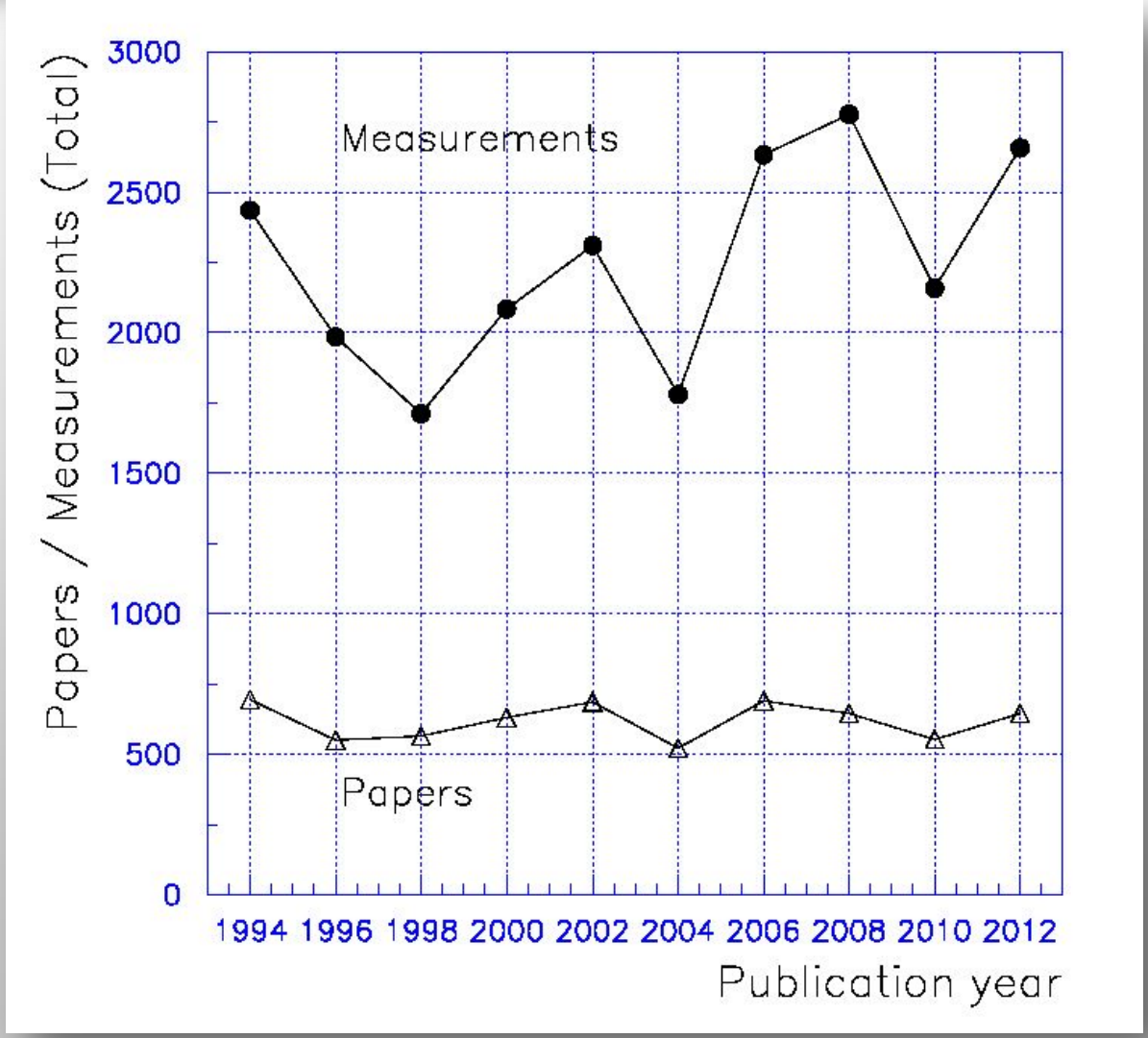
### $\Gamma(J/\psi(1S)a_1(1260))/\Gamma_{\text{total}} \times B(\bar{b} \to B_c)$

| VALUE | CL% | DOCUMENT ID |
|---|---|---|
| **$< 1.2 \times 10^{-3}$** | 90 | [15] ACKERSTAFF |

[15] ACKERSTAFF 98O reports $B(Z \to B_c X)/B(Z$ –

# Trends



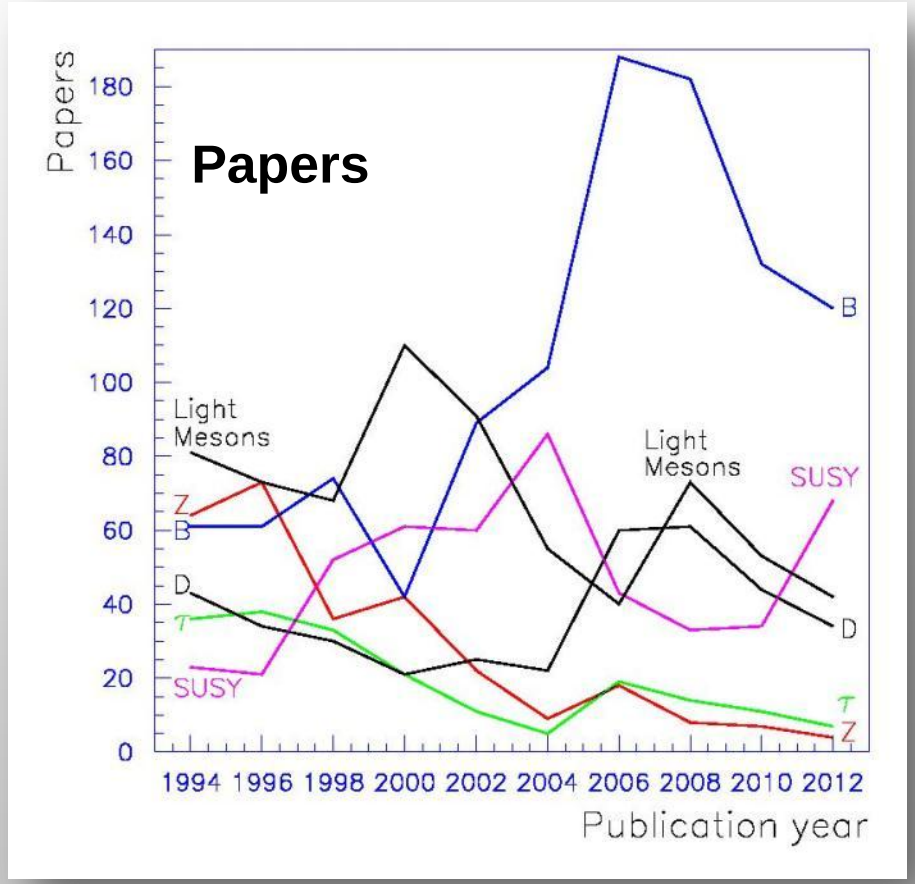


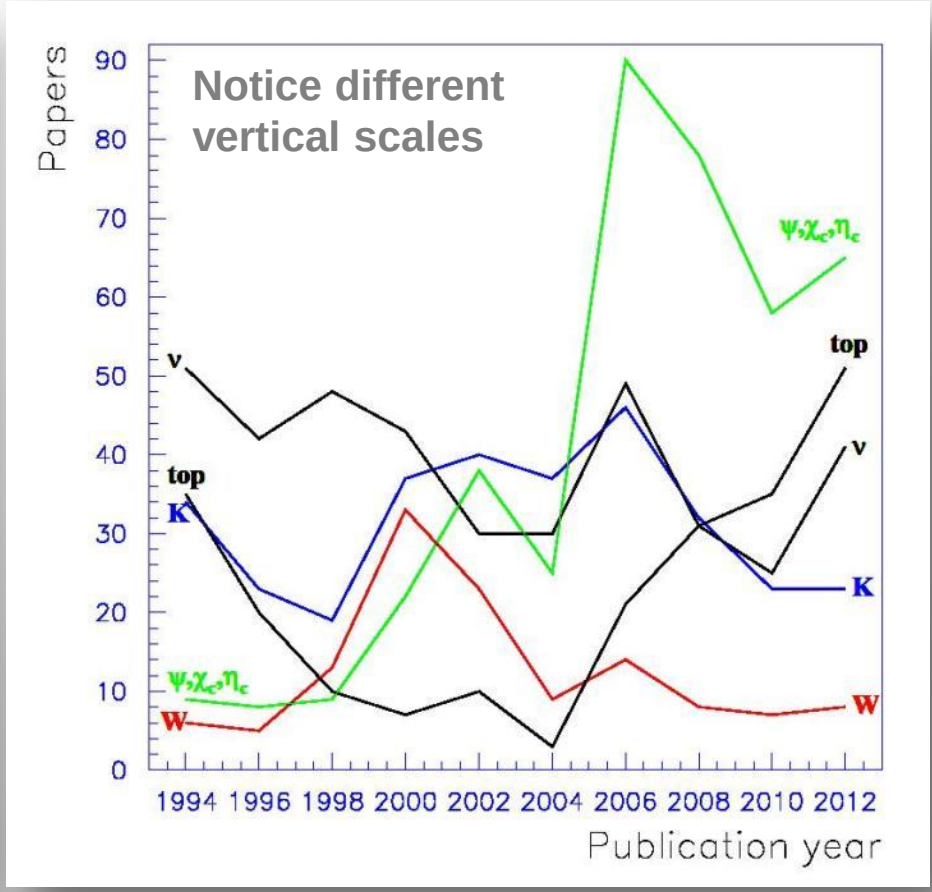

**Some editions are more or less than 24 months, yielding fluctuations in graph.**

# Trends in coverage



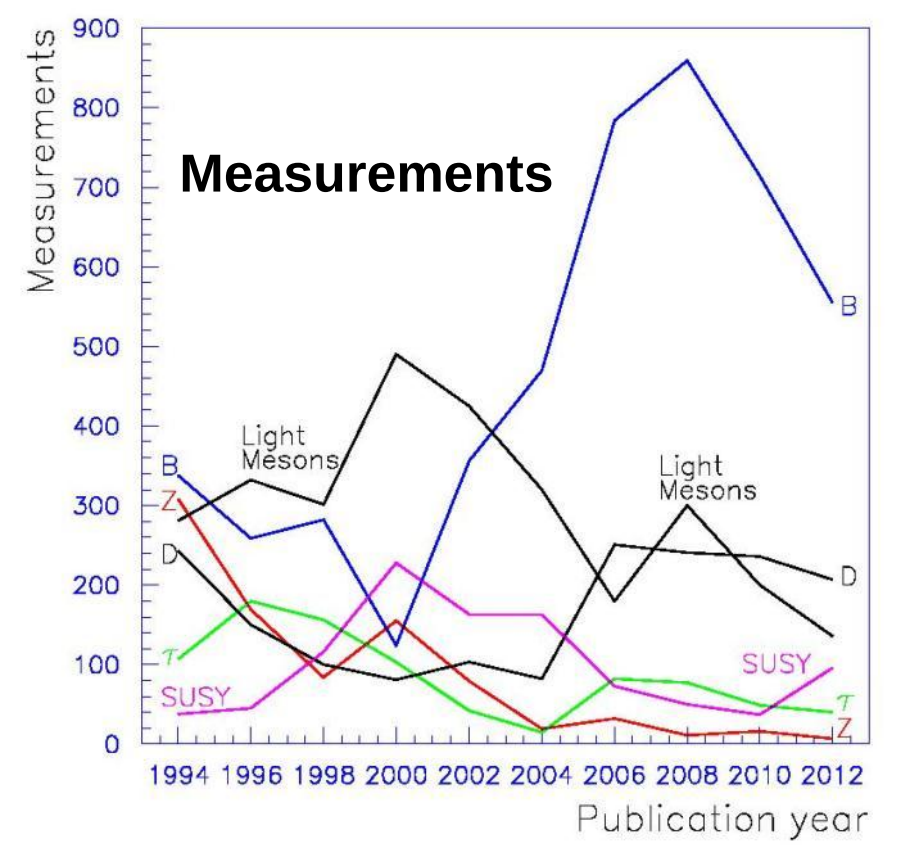
**179/132/120 B papers in 2008/2010/2012 editions**

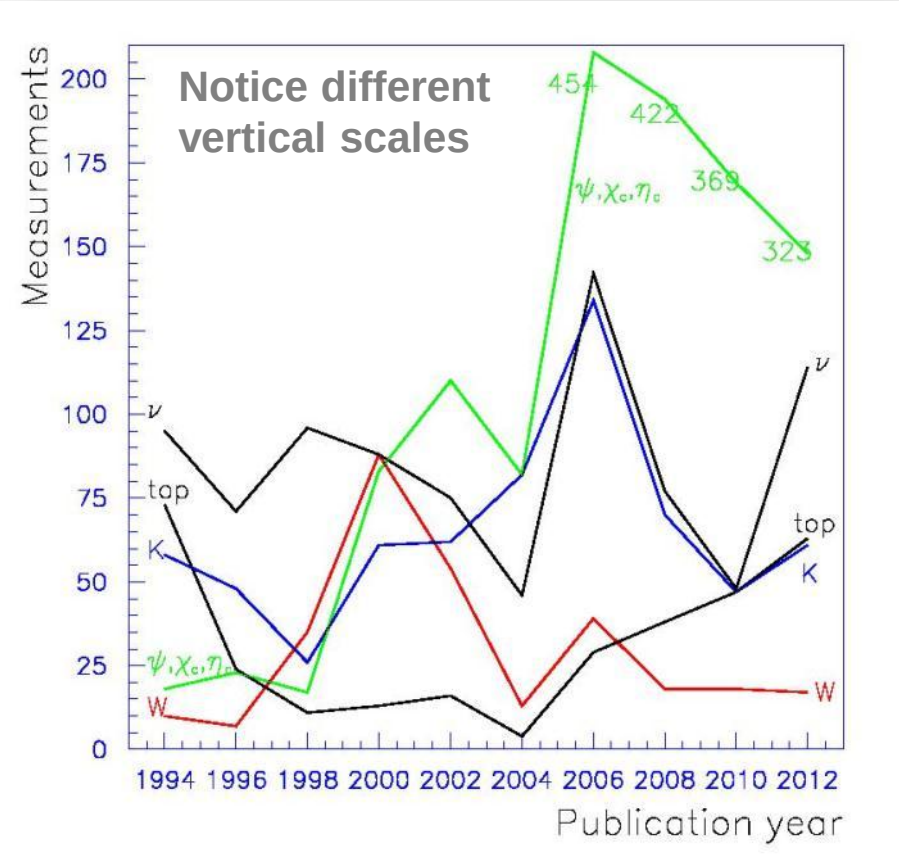


# Trends in coverage

**862/714/555 B measurements in 2008/2010/2012 editions**



# New Papers in RPP-2012

| Papers | 2008 | 2010 | 2012 |
|---|---|---|---|
| W Boson | 8 | 7 | 8 |
| Z Boson | 8 | 7 | 4 |
| $\tau$ Lepton | 14 | 11 | 7 |
| Neutrinos and mixing | 31 | 25 | 41 |
| Quarks (u,d,c,s,b) | 18 | 17 | 20 |
| Top quark | 31 | 35 | 51 |
| b', t' quarks | 3 | 1 | 5 |
| $\gamma$, e, $\mu$, $\pi$, $\eta$ | 22 | 20 | 15 |
| K mesons | 32 | 23 | 23 |
| D and $D_s$ mesons | 61 | 44 | 34 |
| B and $B_s$ mesons | 179 | 132 | 120 |
| Supersymmetry | 33 | 34 | 68 |
| Axions | 18 | 21 | 21 |
| Higgs | 12 | 34 | 51 |
| W', Z' | 18 | 16 | 36 |
| Compositeness | 6 | 5 | 12 |
| Extra dimensions | 11 | 10 | 17 |
| Other searches | 4 | 12 | 37 |
| Free q, monopoles | 1 | 3 | 2 |
| Baryons | 33 | 23 | 38 |
| $\psi$, $\eta_c$, $\chi_c$, $\chi_b$, upsilon | 78 | 72 | 65 |
| Other unstable mesons | 66 | 58 | 106 |
| TOTAL | 645 | 553 | 644 |

| Measurements | 2008 | 2010 | 2012 |
|---|---|---|---|
| W Boson | 18 | 18 | 17 |
| Z Boson | 11 | 16 | 7 |
| $\tau$ lepton | 77 | 49 | 40 |
| Neutrinos and mixing | 77 | 48 | 114 |
| Quarks (u,d,c,s,b) | 42 | 33 | 51 |
| Top quark | 38 | 47 | 63 |
| b', t' quarks | 3 | 1 | 6 |
| $\gamma$, e, $\mu$, $\pi$, $\eta$ | 44 | 40 | 23 |
| K mesons | 70 | 47 | 61 |
| D and $D_s$ mesons | 241 | 236 | 207 |
| B and $B_s$ mesons | 862 | 714 | 555 |
| Supersymmetry | 50 | 37 | 96 |
| Axions | 18 | 22 | 22 |
| Higgs | 15 | 45 | 68 |
| W', Z' | 32 | 29 | 60 |
| Compositeness | 15 | 5 | 13 |
| Extra dimensions | 12 | 14 | 19 |
| Other searches | 10 | 22 | 65 |
| Free q, monopoles | 1 | 4 | 2 |
| Baryons | 362 | 88 | 667 |
| $\psi$, $\eta_c$, $\chi_c$, $\chi_b$, upsilon | 422 | 329 | 323 |
| Other unstable mesons | 355 | 369 | 568 |
| TOTAL | 2778 | 2167 | 2658 |

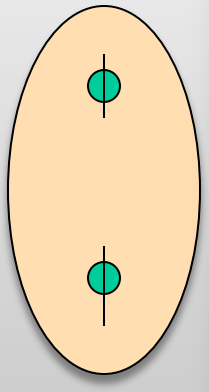
# Impact

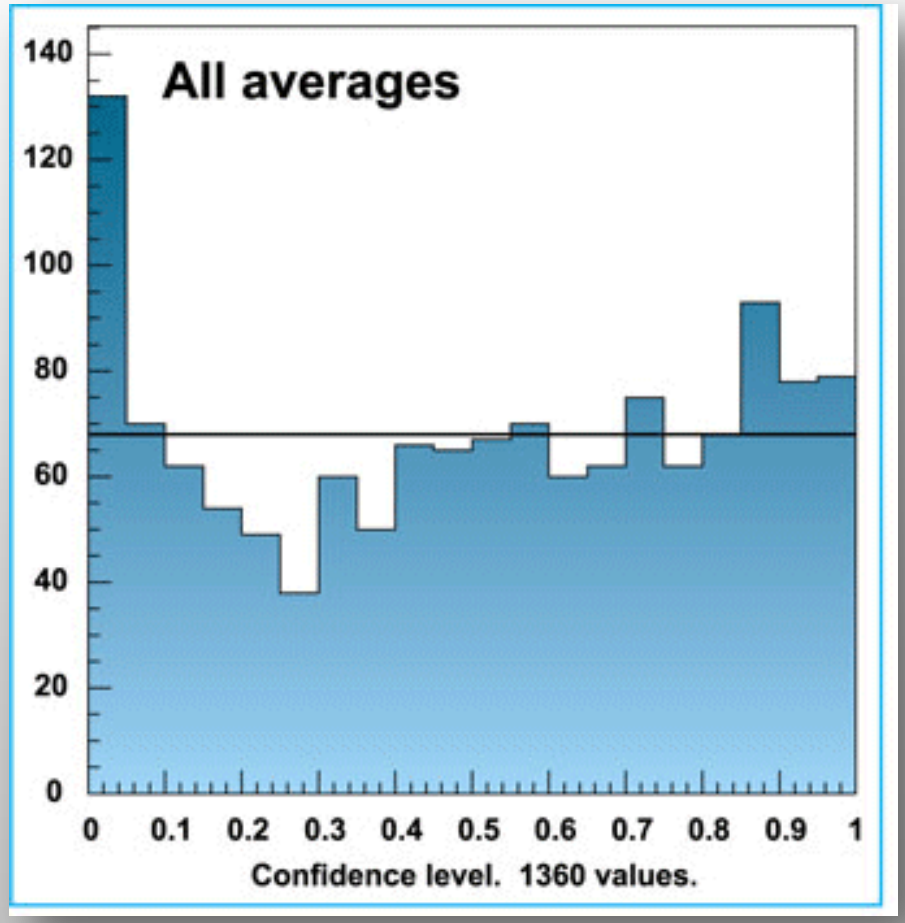
- 31,000 Booklets requested
- 15,000 RPP books requested
- 11 million hits/year on website (>180 countries)
- 41,000 citations of RPP
- Most cited publication in HEP

# Confidence Levels of Averages

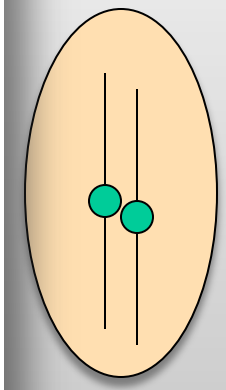
Each point is one average.

Peak at left due to conflicting measurements.






Broad peak at right due to conservative error bars.



# Publishing

## Four publishers bid on RPP and Booklet:

**Physics Letters B** **(Elsevier)**

**Physical Review D** **(AIP)**

**Journal of Physics G** **(IoP)**

**European Physical Journal C** **(Springer)**

# DOE Review of PDG



**on September 12, 2008 (all day) in Washington DC**

- **Extremely successful.**
- **New resources are a game-changer.**
- **Addressed many issues.**
- **Solved many problems.**

| Item | Funded |
|---|---|
| Additional physicist | 2 |
| Computing upgrade | 6 FTE |
| Programmer | 0.5 |

# Vital roles of
# CERN, Japan, INSPIRE

# CERN



## 50+ year collaboration

**Administration for CERN funding (Michael Doser).**

**Pays publisher directly for their copies.**

**Oversees support for the Meson Team (space, travel), which is mostly non-CERN people who meet at CERN.**

**Mirror website maintained.**

**Eleven CERN members (as individuals):**
**Doser, Basaglia, Ceccucci, Gurtu, Hoecker, Holtkamp, Roesler, Salam, Sauli, Silari, and Skands.**

# An Essential Collaboration

**Silver Anniversary**

**25 Years of Japan-US Collaboration**

**2011**

- **The PDG Japan-US Collaboration has evolved into a very successful and essential effort that produces materials used by physicists around the world.**
- **The quality of the Review of Particle Physics is very much enhanced by the participation of Japanese physicists.**
- **4460 products mailed to Japanese physicists (which they pay for)**

# Japan



## 26-year collaboration

**Administration for Japanese funding (Ken-ichi Hikasa)**

**Oversees support for Japanese members (travel).**

**Mirror website maintained.**

**In charge of major sections.**

# Japan



## Reviews and Data Sections

- Neutrinos
- CKM Quark Mixing
- Top quark
- Higgs bosons
- Supersymmetry
- Compositeness of quarks and leptons
- Axions
- Heavy bosons (W', Z', etc.)
- Even more exotic particles.

# Japan

**Leadership (past and present)**

- Dr. Kasuke Takahashi
- Prof. Yoshio Oyanagi
- Prof. Ken-ichi Hikasa (current leader)

**Eleven Japanese physicists**

- Dr. Kaoru Hagiwara (KEK)
- Dr. Shoji Hashimoto (KEK)
- Prof. Ken-ichi Hikasa (Tohoku University)
- Prof. Hitoshi Murayama (WPI Tokyo)
- Dr. Kenzo Nakamura (KEK)
- Dr. Yoshihide Sakai (KEK)
- Prof. Takayuki Sumiyoshi (Tokyo Metropolitan U.)
- Prof. Fuminobu Takahashi (Tohoku University)
- Prof. Masaharu Tanabashi (Nagoya University)
- Prof. Taizan Watari (Tokyo)
- Dr. Akira Yamamoto (KEK)

# INSPIRE Collaboration



## Many years collaboration (> 20)

**Coordination with SLAC Library group.**
**SPIRES → Now INSPIRE (and CERN)**

**Yields our ability to link to the papers from which the measurements come.**

**Many discussions of improved coverage for the HEP community.**

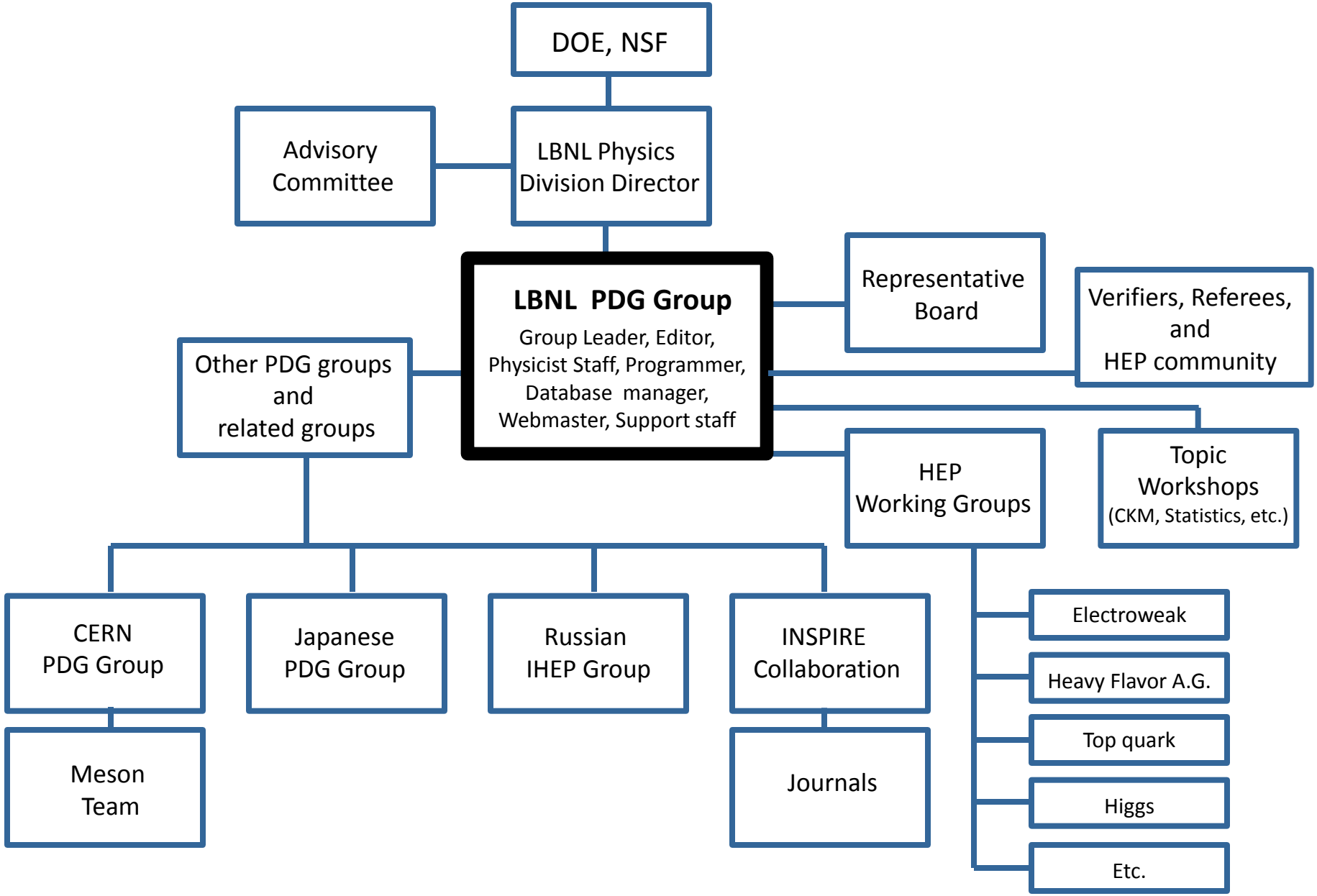
# The End

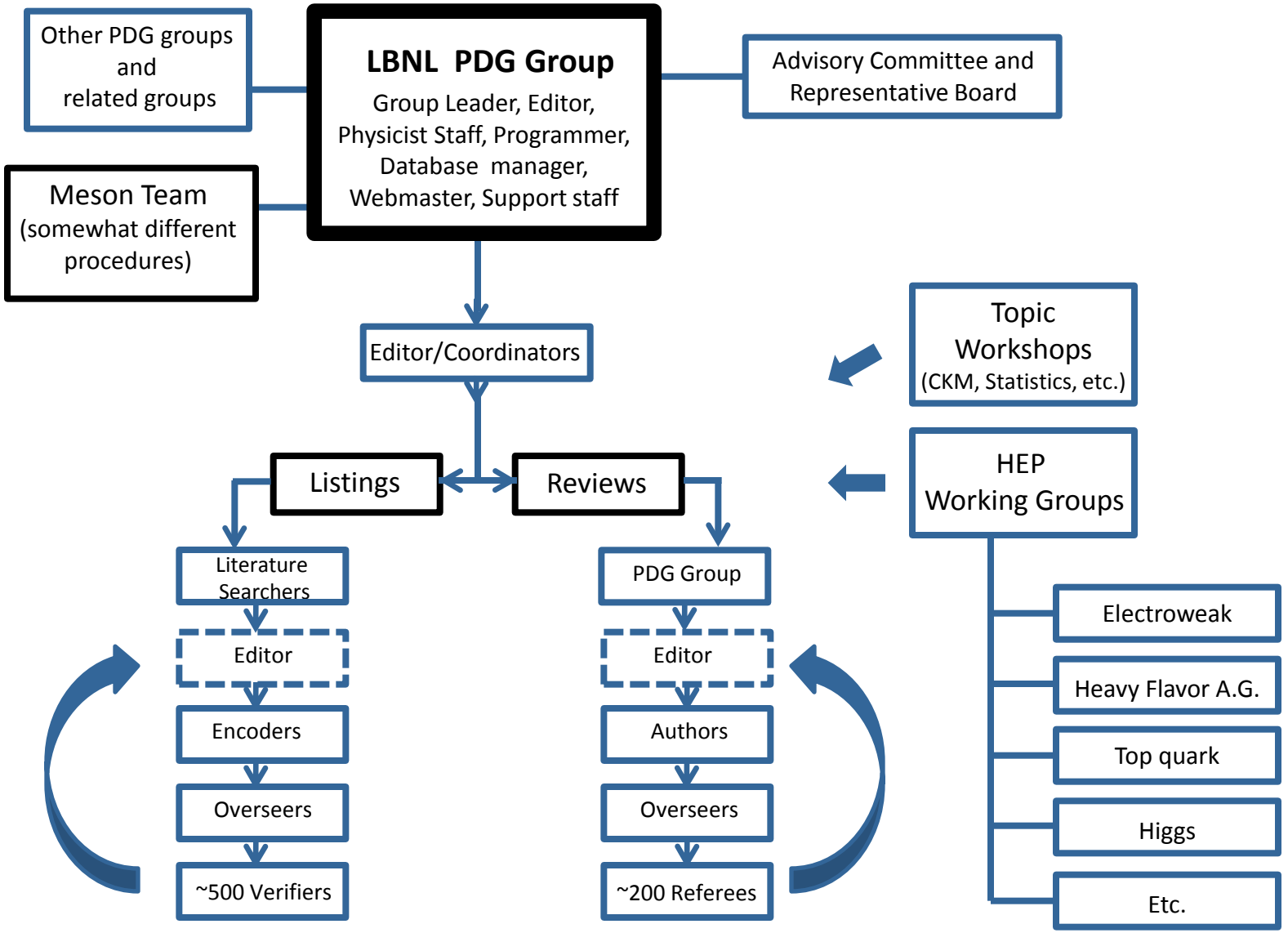
# of Introduction

# Procedures

**The process of producing the**

***Review of Particle Physics***


DOE, NSF
Advisory Committee
LBNL Physics Division Director
LBNL PDG Group
Group Leader, Editor, Physicist Staff, Programmer, Database manager, Webmaster, Support staff
Representative Board
Verifiers, Referees, and HEP community
Other PDG groups and related groups
HEP Working Groups
Topic Workshops (CKM, Statistics, etc.)
CERN PDG Group
Japanese PDG Group
Russian IHEP Group
INSPIRE Collaboration
Meson Team
Journals
Electroweak
Heavy Flavor A.G.
Top quark
Higgs
Etc.


Other PDG groups and related groups
LBNL PDG Group
Group Leader, Editor, Physicist Staff, Programmer, Database manager, Webmaster, Support staff
Advisory Committee and Representative Board
Meson Team (somewhat different procedures)
Editor/Coordinators
Topic Workshops (CKM, Statistics, etc.)
HEP Working Groups
Listings
Reviews
Literature Searchers
Editor
Encoders
Overseers
~500 Verifiers
PDG Group
Editor
Authors
Overseers
~200 Referees
Electroweak
Heavy Flavor A.G.
Top quark
Higgs
Etc.

# Literature Search

**Complete Literature Search by two people of 20 journals (600 papers per edition predominantly from PL, PRL, PR and EPJ)**

**Enter Literature search results in database**

**Distribute assignments of papers to Encoders and Overseers**

# Procedures



## Encoding

**Each Paper Read Carefully by Two People: by encoder and by overseer**

**Encoder and Overseer initiate data entry**

**Encoding data entered into database:**
**Sections have very different formats**

**Create new sections, delete sections, reorganize/combine sections**

# Procedures



## Reviews

**Write/edit Reviews describing content of and/or problems in a given section**

**Referee each review and note (3-5 referees)**

**Place reviews into system so can produce book and web versions**

# Procedures



## Final processing

**Edit all sections for consistency, errata, quality, etc.**

**Request Verification of every entry from each experiment**

**Enter corrections/changes from Verifications**

**Calculate Averages, Fits and Best Limits.**
**Many of these are unique by section**

**Prepare Summary Table**

**Prepare Conservation Laws table (with impact on Listings and Summary Table)**

# Procedures



## Production

**Post Listings and Reviews on web**

**Produce 1526-page book of Summary Tables, Listings, Reviews**

**Produce web versions of everything in book**

**Produce 320-page Booklet with Summary Tables and abridged version of reviews**

# Quality Assurance

**The HEP Community and many others depend on us for accuracy and integrity**

# Quality Assurance

- All reviews have 3-5 referees.
- Every item of data that is entered is checked by the experiments (700 people help).
- PDG Advisory Committee reviews all PDG operations

**We strive to only report what is a fair consensus of the community.**
E.g.- For the growing B sections, the three encoders are from Belle, LHCb, and Tevatron.

**We invite comments from the collaborations on many sections.**

**We organize mini-workshops when we need to consider expanded and improved coverage of a section** (such as D mesons, B mesons, neutrinos, tau leptons, CKM, extra dimensions, ....)

# PDG Advisory Committee

| | |
|---|---|
| **Patrick Janot – Chair** | **(CERN)** |
| **Deborah Harris** | **(Fermilab)** |
| **James Olsen** | **(Princeton)** |
| **Gilad Perez** | **(CERN/Weizmann)** |
| **Junichi Tanaka** | **(U. of Tokyo)** |

# Distinguished Members of Past Advisory Committees

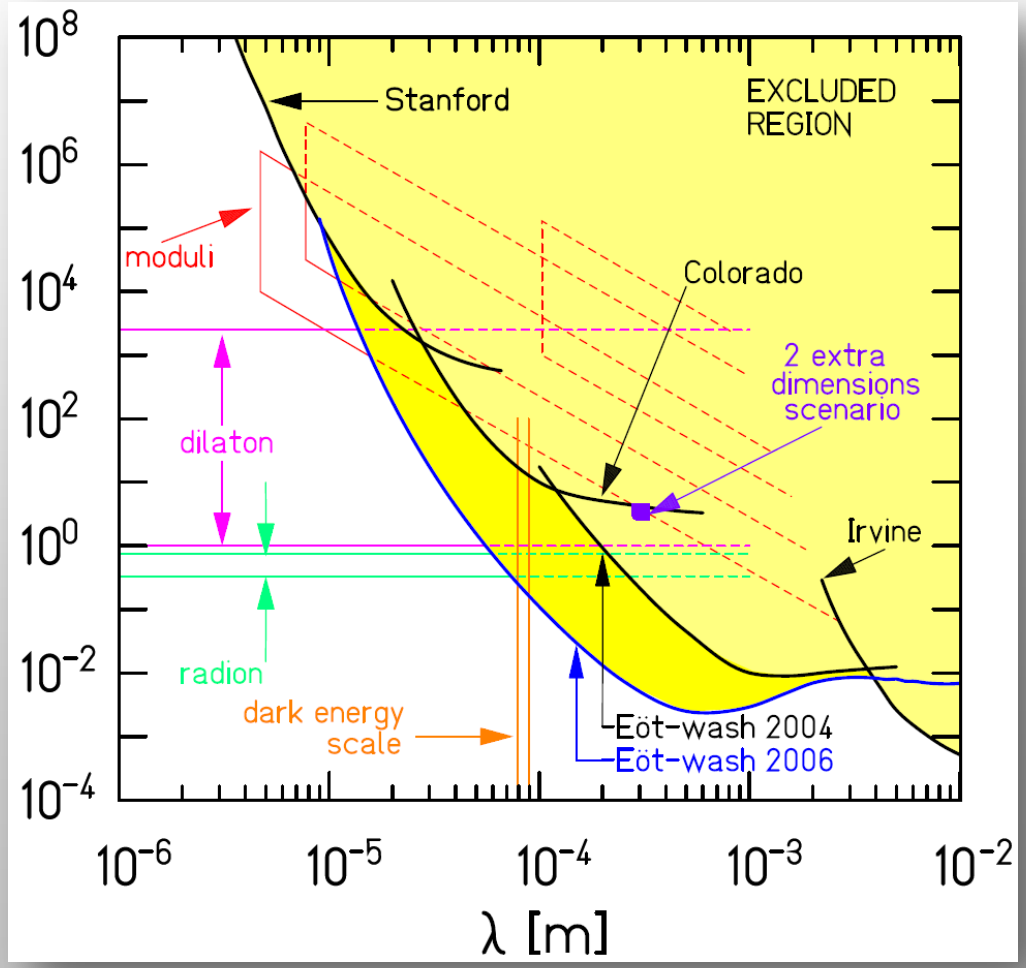
| | |
|---|---|
| Peter Zerwas | Persis Drell |
| Taka Kondo | Dieter Schlatter |
| Michael Turner | Paul Langacker |
| Michel della Negra | Mark Wise |
| Jonathan Dorfan | Stephen Ellis |
| Ann Kernan | Chris Quigg |
| Lincoln Wolfenstein | Mike Whalley |
| Gary Feldman | Jonathan Rosner |
| Rudiger Voss | Fred Gilman |
| Hiroaki Aihara | Gustaaf Brooijamns |

# Vital PDG Workshops



## Workshops lead to improved coverage

- Neutrino
- CKM
- D Meson
- $\tau$ lepton
- Extra-dimensions →
- Statistics




**Constraints on deviations from Newton's gravitational force law**

# Collaboration with Working Groups

Coordination with working groups at

Tevatron, B-factories, LEP on:

- Electroweak fits,
- B lifetimes, B mixing,
- $V_{cb}$ and $V_{ub}$
- top quark mass, etc.

PDG role in CKM workshops, Statistics workshops, etc.

Working with new LHC groups including

Higgs Working Group (top group is becoming active).