Review of the

Particle Data Group

by the Department of Energy

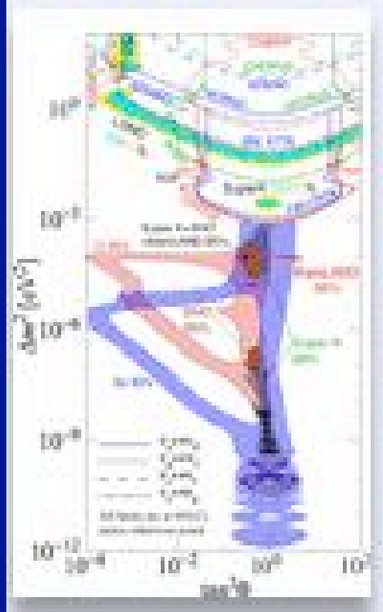
Significance and Relevance of the PDG to HEP

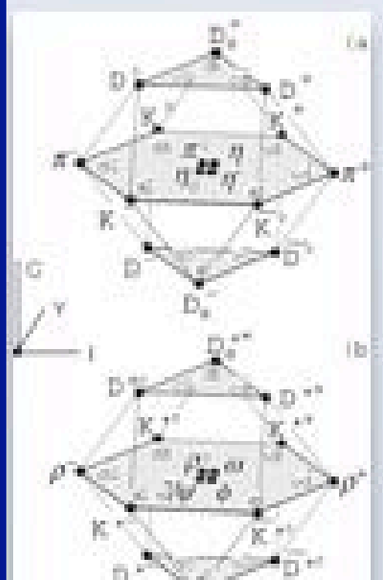
The PDG Empire

LBNL Leads

LBNL leads the
Particle Data Group collaboration
of 170 authors
from 20 countries and 108 institutions
+ 700 consultants in the HEP community

PDG 50th Anniversary Festivities





PDG 50th ANNIVERSARY FESTIVITIES

Date: Saturday, September 23, 2006

Location: Lawrence Berkeley National Laboratory
Building 50 Auditorium

Also celebrating
75th birthday of Matts Roos
80th birthday of Art Rosenfeld

PROGRAM

Art Rosenfeld - PDG History
Matts Roos - Meson Team History
Chris Quigg - Standard Model Theory
Michael Riordan - Toward the Standard Model
Hiroaki Aihara - B Physics
Boris Kayser - Neutrinos
Lina Galtieri - Top Quark
Michael Turner - Cosmology
John Ellis - Searches for New physics
Michelangelo Mangano - LHC and its Impact on PDG
Michael Barnett - Summary
Banquet

Review of Particle Physics

645 new papers with 2778 measurements

108 Reviews written or edited by PDG

RPP: 1344 pages (in 2008)

Booklet: 320 pages (in 2006)

Listings and Reviews

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

The hits on

Data Listings = Reviews

almost exactly equal.

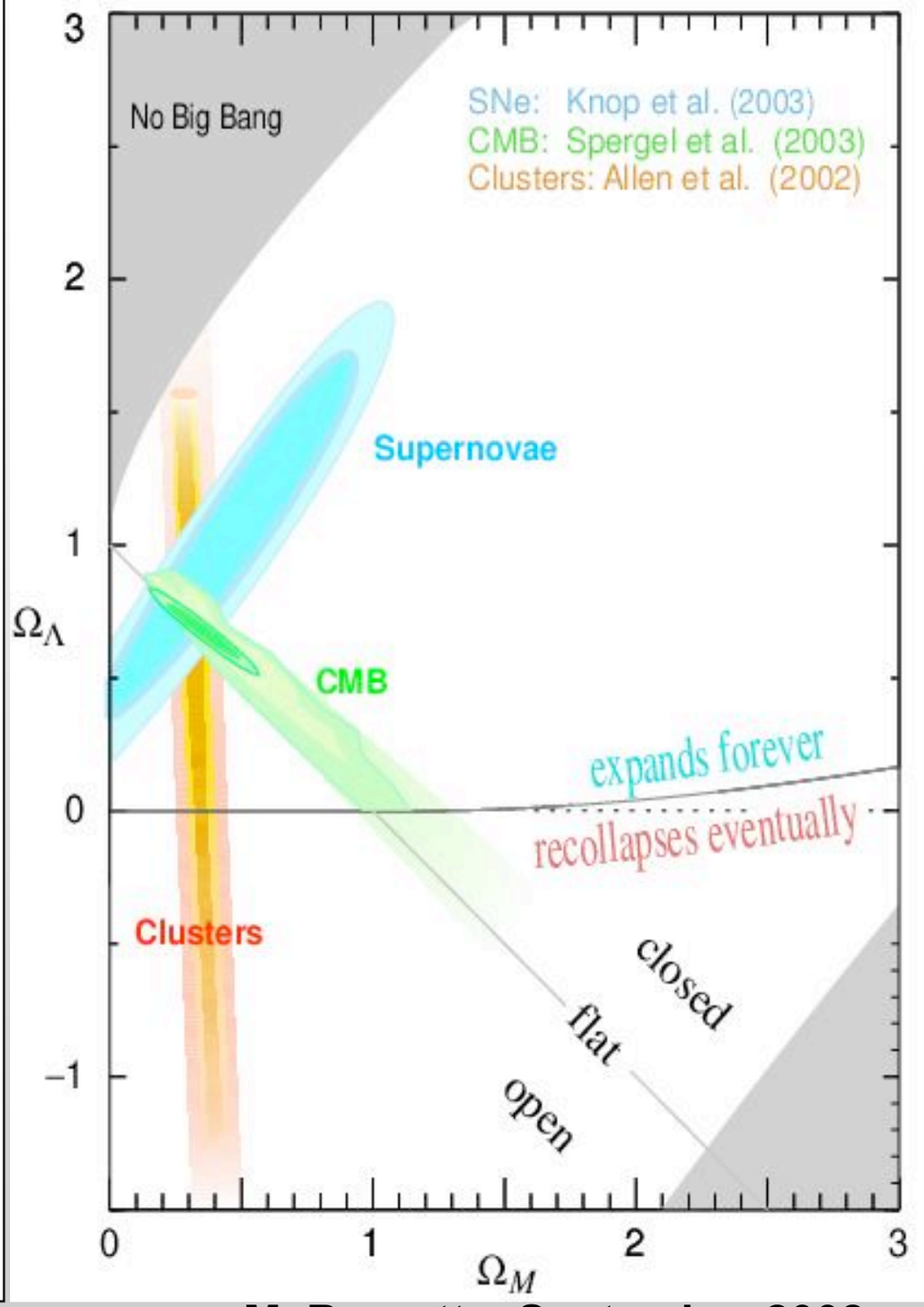
Clearly people care about both.

Astrophysics & Cosmology

10 years ago: **Very little**

Now:

Astrophysical Constants
Big Bang Cosmology
Cosmological Parameters:
H_0, Λ, Ω, etc.
Experimental Tests of Gravitational Theory
Dark Matter
Cosmic Background Radiation
Cosmic Rays



B Meson Section 1984

Entire section was one 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 D0BAR 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 D0BAR 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 2008

Section is 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
6.276 ±0.004 OUR AVERAGE				
6.2756 ± 0.0029 ± 0.0025	[1] AALTONEN	08M	CDF	$p\bar{p}$ 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 ± 0.20 events.

$B_c^\pm$ MEAN LIFE

VALUE (10^{-12} s)	DOCUMENT ID		TECN	COMMENT
0.46 ±0.07 OUR AVERAGE				
$0.463^{+0.073}_{-0.065} \pm 0.036$	[4] ABULENCIA	06O	CDF	$p\bar{p}$ at 1.96 TeV
$0.46^{+0.18}_{-0.16} \pm 0.03$	[4] ABE	98M	CDF	$p\bar{p}$ 1.8 TeV

[4] The lifetime is measured from the $J/\psi(1S)e$ decay vertices.

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

VALUE	CL%	DOCUMENT ID		TECN	C
$< 8.2 \times 10^{-5}$	90	[9] BARATE	97H	ALEP	e
• • • We do not use the following data for averages, fits, limits, etc					
$< 2.4 \times 10^{-4}$	90	[10] ACKERSTAFF	98O	OPAL	e
$< 3.4 \times 10^{-4}$	90	[11] ABREU	97E	DLPH	e
$< 2.0 \times 10^{-5}$	95	[12] ABE	96R	CDF	p

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

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

[11] ABREU 97E value listed is for an assumed $\tau_{B_c} = 0.4$ ps and imp $\tau_{B_c} = 1.4$ ps.

[12] ABE 96R reports $B(b \to B_c X)/B(b \to B^+ X) \cdot B(B_c^+ \to J/\psi(1S)K^+) < 0.053$ at 95%CL for $\tau_{B_c} = 0.8$ ps. It changes $0.17 \text{ ps} < \tau_{B_c} < 1.6$ ps. We rescale to our PDG 96 values of B(and $B(B^+ \to J/\psi(1S)K^+) = 0.00101 \pm 0.00014$.

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

VALUE	CL%	DOCUMENT ID		TECN	C
$< 5.7 \times 10^{-4}$	90	[13] ABREU	97E	DLPH	e

[13] ABREU 97E value listed is independent of 0.4 ps $< \tau_{B_c} < 1.4$ ps.

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

VALUE	CL%	DOCUMENT ID		TECN	C
$< 1.2 \times 10^{-3}$	90	[14] ACKERSTAFF	98O	OPAL	e

[14] ACKERSTAFF 98O reports $B(Z \to B_c X)/B(Z \to q\bar{q}) \times B(B_c$ $< 5.29 \times 10^{-4}$ at 90%CL. We rescale to our PDG 98 values of

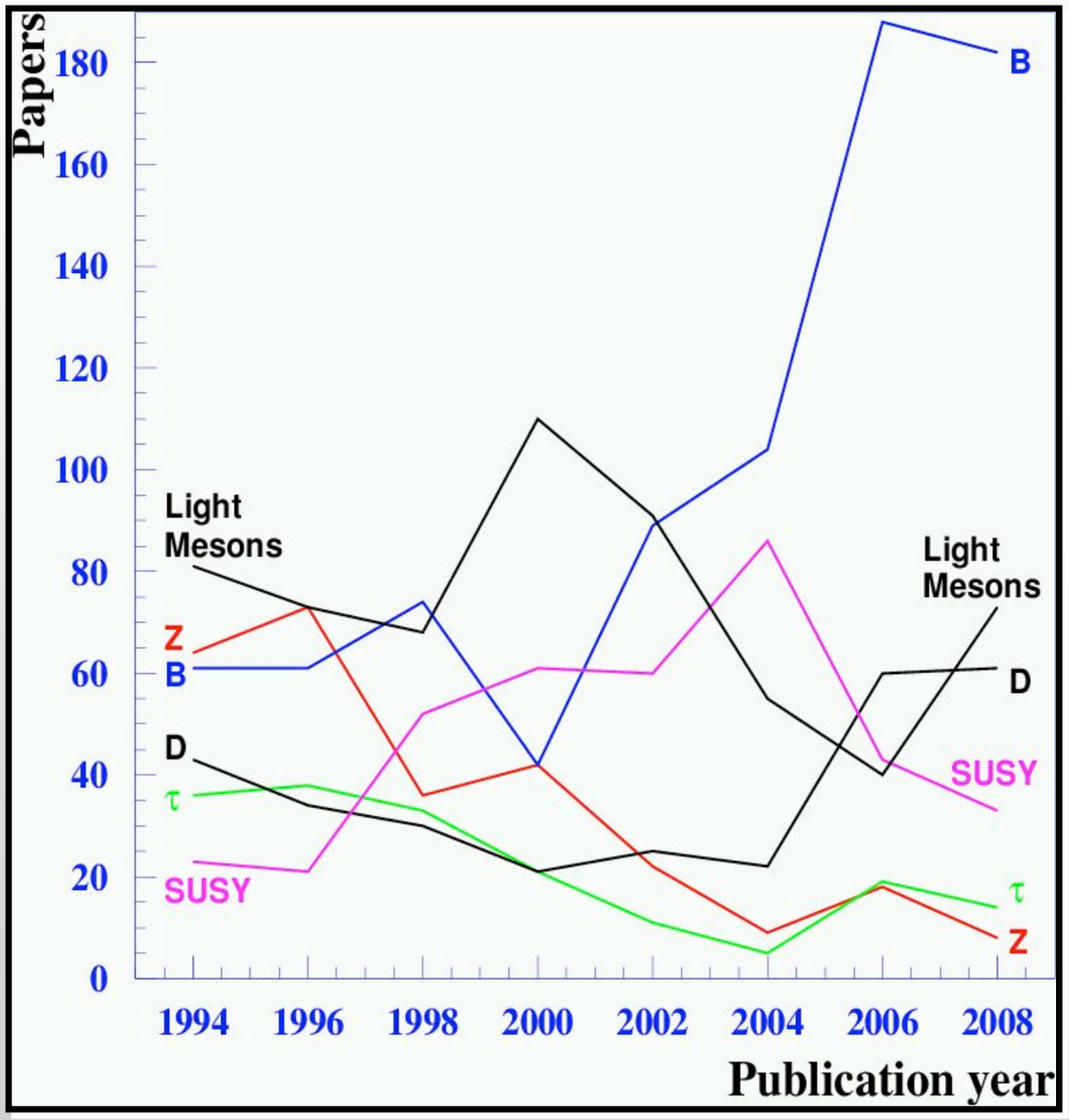
$\Gamma(D^*(2010)^+\overline{D}^0)/\Gamma_{total} \times B(\bar{b} \to B_c)$

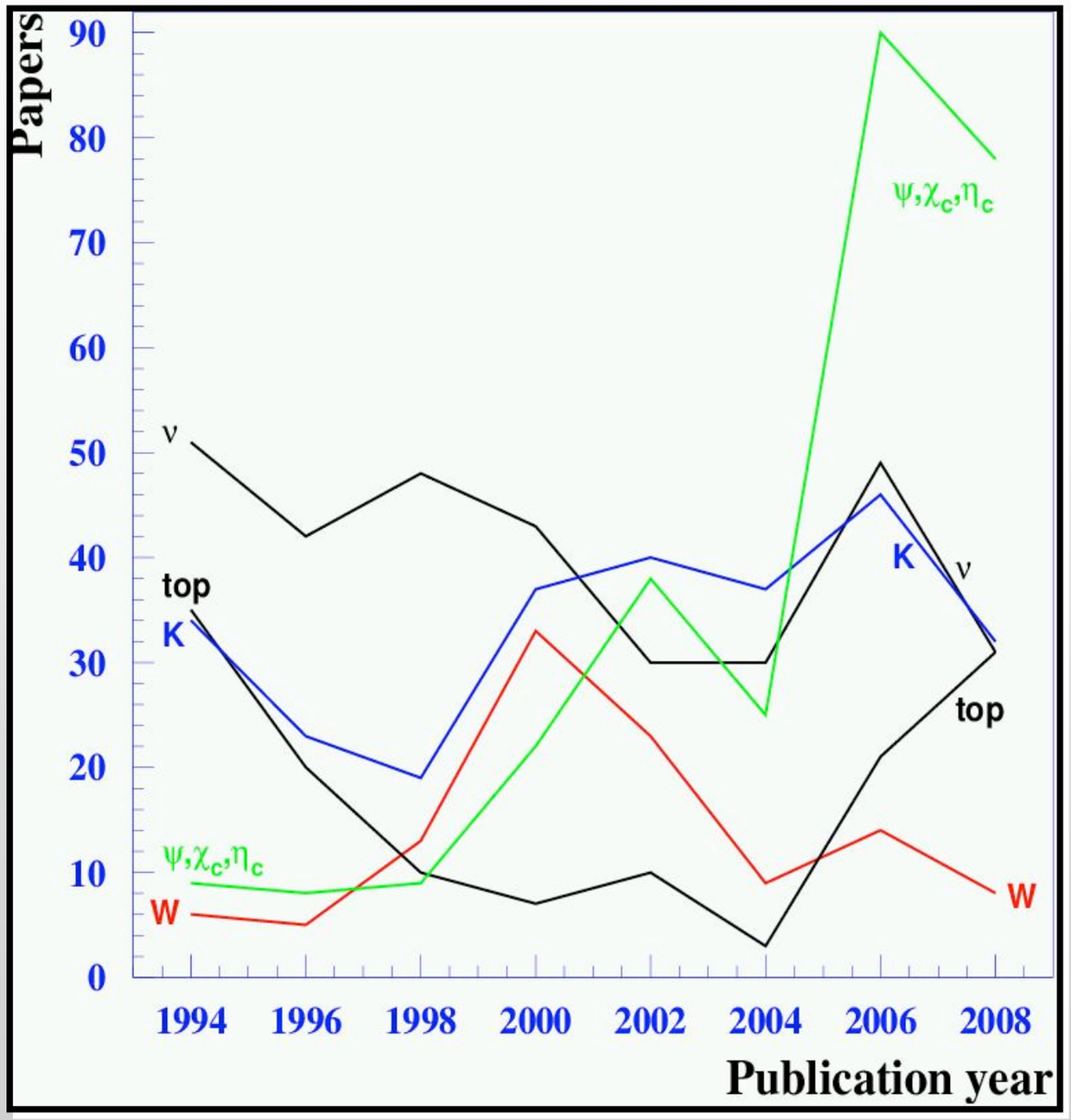
VALUE	CL%	DOCUMENT ID		TECN	C
$< 6.2 \times 10^{-3}$	90	[15] BARATE	98Q	ALEP	e

[15] BARATE 98Q reports $B(Z \to B_c X) \times B(B_c \to D^*(2010)^+$ 90%CL. We rescale to our PDG 98 values of $B(Z \to b\bar{b})$.

Trends in coverage

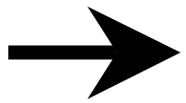
186/182 B papers in 2006/2008 editions





Notice different vertical scales

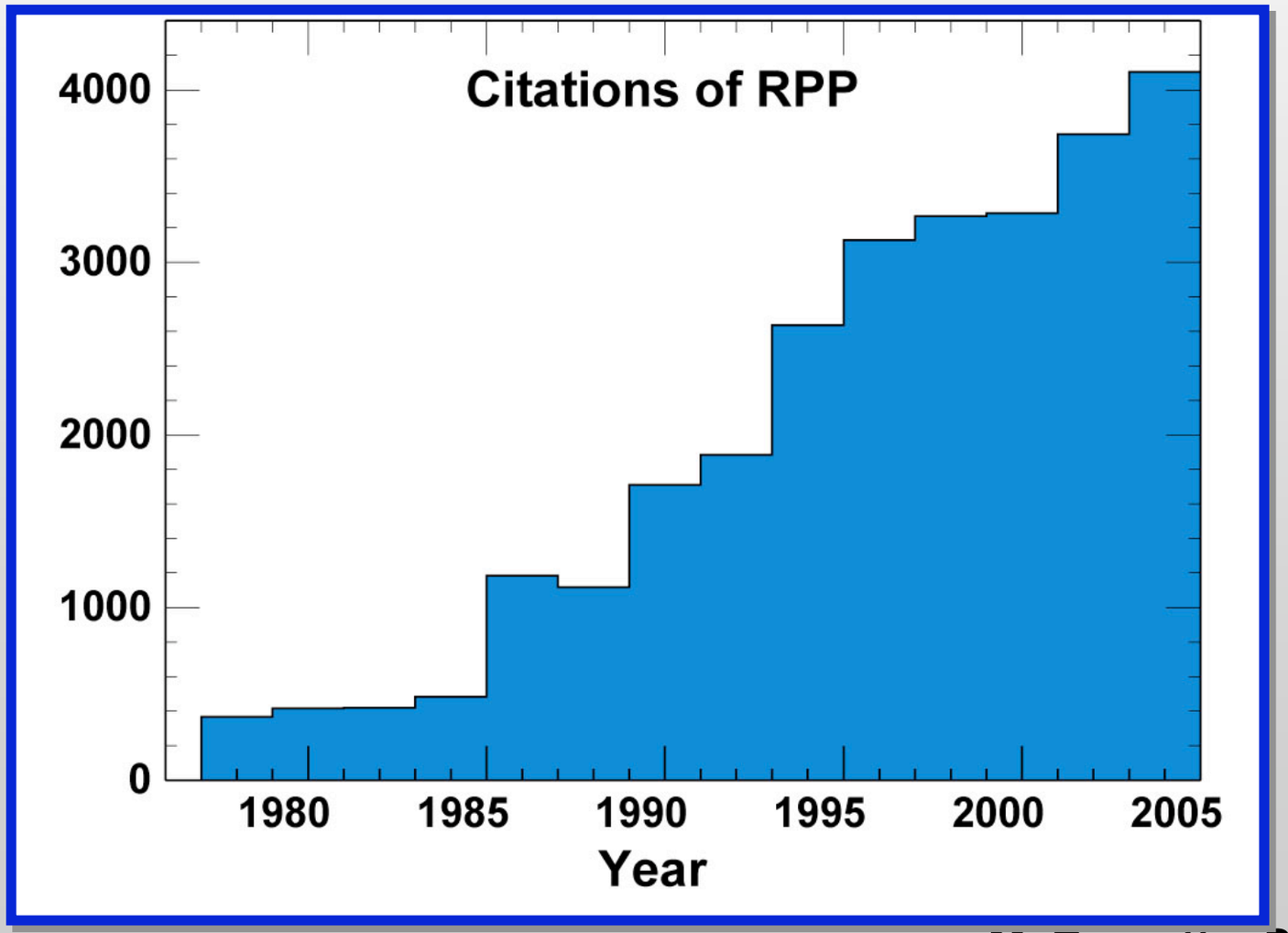
Dynamic Improvements by PDG



- 31,000 Booklets requested
- 16,000 RPP books requested
- 7 million hits/year on website (>180 countries) 2008 is projected at 10 million.
- 30,000 citations of RPP
- Most cited publication in HEP

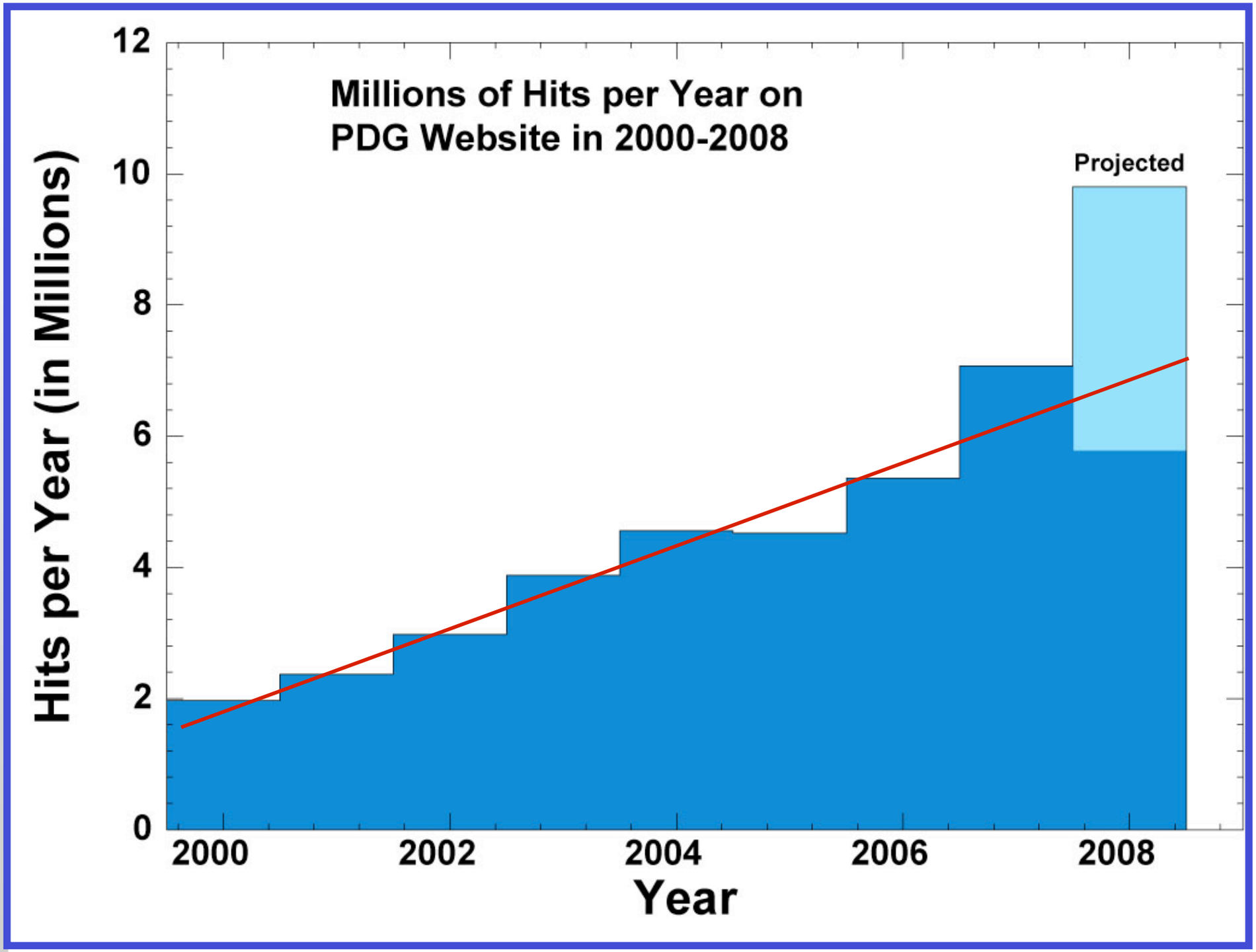
Top Cited

The Review is the all-time top cited article in High Energy Physics with 30,000 citations (SLAC-SPIRES)



More Consequences

Excluding mirror sites and excluding Education webpages



Impact

Following the publication of the ISI Journal Citation Reports, …

Journal of Physics G has increased its Impact Factor to 3.485. This is a 96% increase on last year's result and shows that researchers who publish with us are in the right place to be cited by their peers. JPhysG is also the highest impact factor of any original research journal in ISI's category of Nuclear Physics!

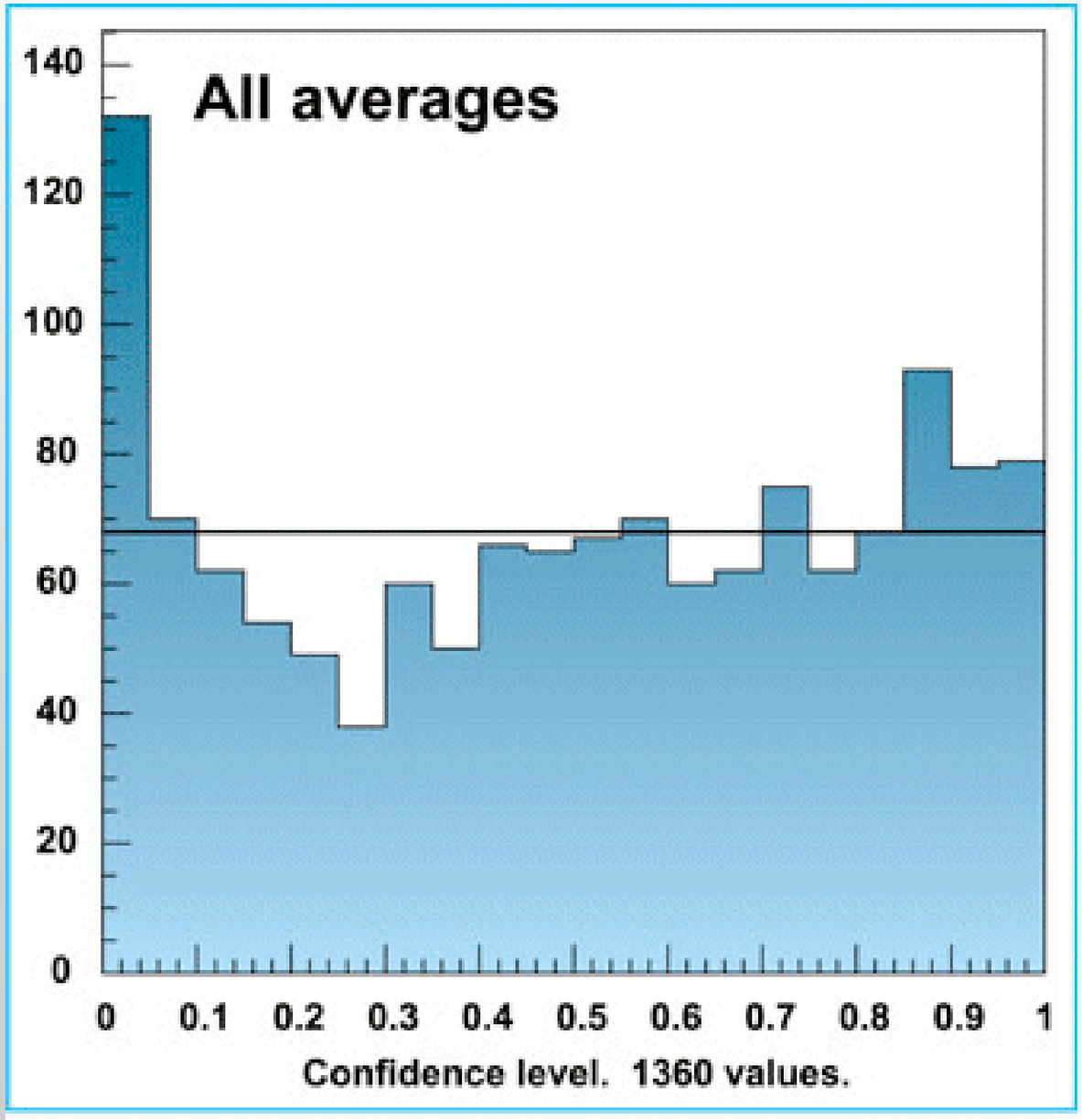
With the increase in Impact Factor, there has never been a better time to publish with JPhysG to achieve worldwide visibility for your work. …

Sarah Thompson
Senior Marketing Executive, Journal of Physics G…
IOP Publishing

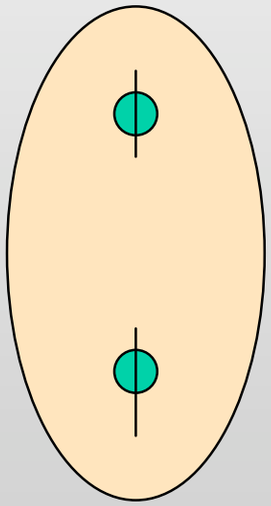
Confidence Levels of Averages

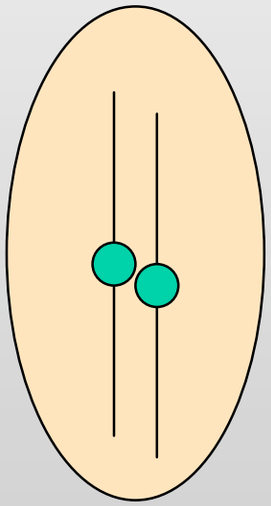
Each point is one average.

Peak at left due to conflicting measurements.



Broad peak at right due to conservative error bars.





Education and Outreach

An extensive and diverse program

Student Books/Booklets

PDG books and booklets are primary educational tools (textbooks for the next generation of physicists).

Booklet:

year	student	grad. fract.
2000	27%	74%
2002	33%	72%
2004	39%	70%
2006	40%	73%
2008*	33%	78%

(% LBNL distribution to students and % of those who are grad students)

* Initial distribution only

RPP Book:

year	student	grad. fract.
2000	24%	78%
2002	31%	76%
2004	38%	75%
2006	37%	77%
2008*	31%	80%

Education and Outreach

Barnett with PDG staff

LHC Awareness Proposal – Initiator and Co-Principal Investigator

US LHC Communications Task Force – Member

ATLAS Education & Outreach Committee – Coordinator

QuarkNet – Co-Principal Investigator

Contemporary Physics Education Project – Founder, Vice Pres.

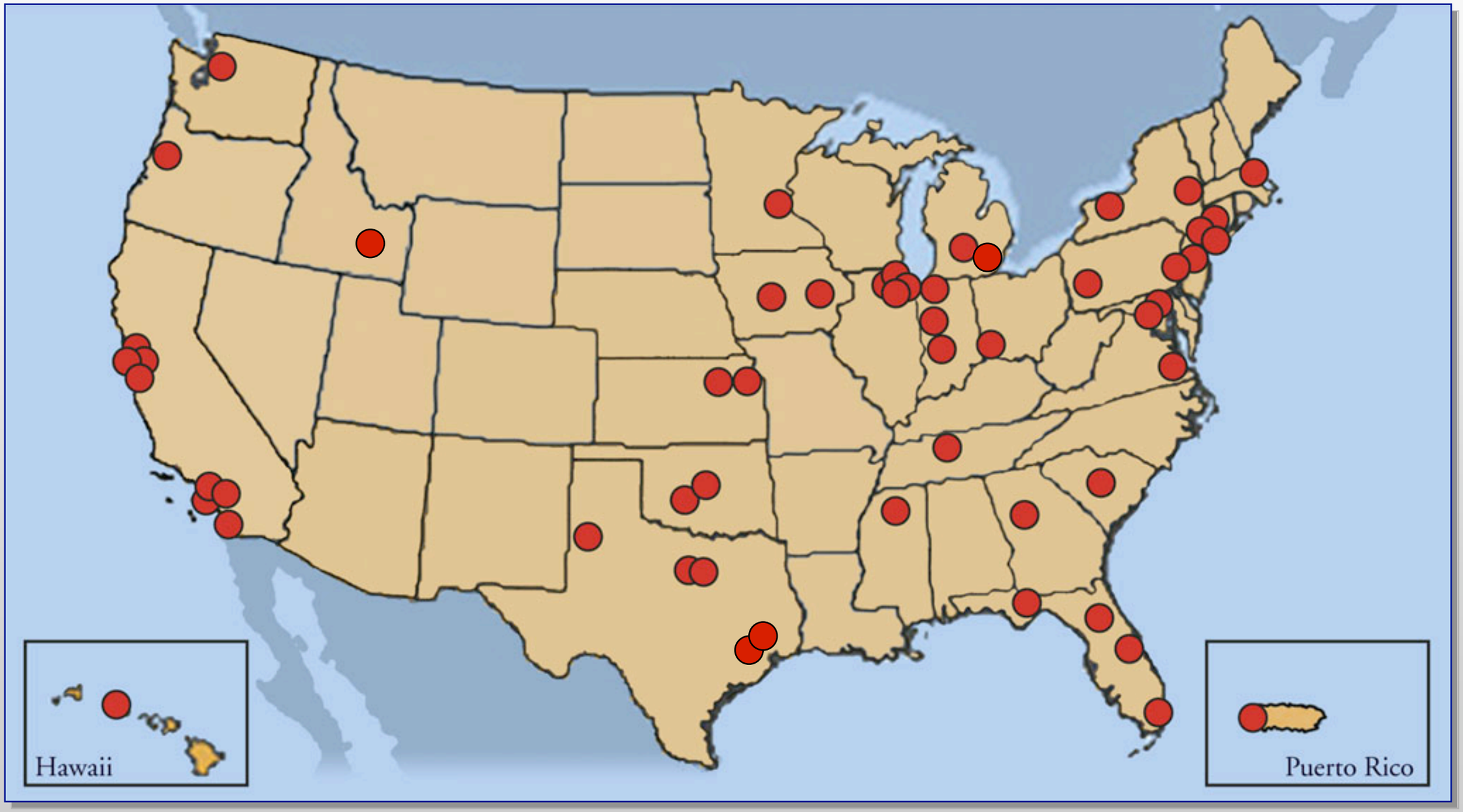
APS-Calif Section – Chair, then Past Chair

American Assoc of Physics Teachers N. Cal. Sec. – Vice Pres.

Homestake DUSEL – Education Advisor

QuarkNet

Helping Develop America's Technological Workforce



QuarkNet

The focus of QuarkNet is to involve teachers and students in our experiments:

Teachers: do research with us and bring that excitement and experience to their classrooms;

Students: analyze web-data in their classrooms.

QuarkNet is getting students excited about science and involved in inquiry-based learning.

by getting scientists and teachers working together.

Nationwide Impact

Centers at 52 universities/labs.

16 different HEP experiments.

570 high schools in 26 states.

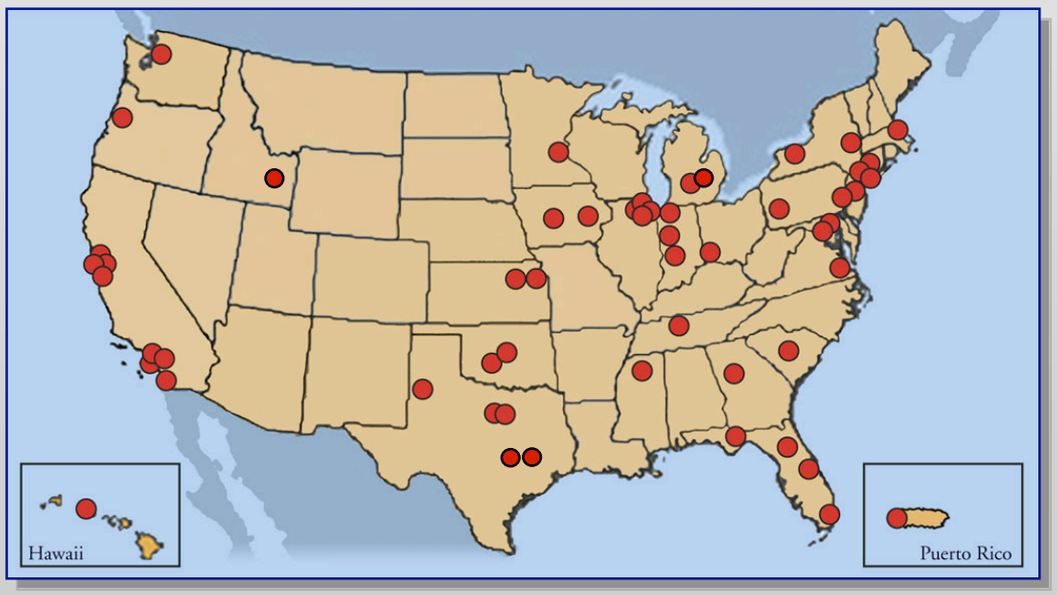
Impacts on 60,000 students/yr.

Changing teachers and teaching by making them part of research collaborations.

Our work with teachers is giving them the ability to attract and train American students.

Goodwill Ambassadors

These teachers (as well as their students and their parents) are a corps of goodwill ambassadors for particle physics.



Student Journalist Program

Funded by US-LHC Awareness Project

Information for participating students, teachers, and parents. Press release

Introduction

The world anticipates incredible discoveries when the Large Hadron Collider, the most powerful particle accelerator ever built, starts running later this year at the CERN laboratory in Geneva, Switzerland. As scientists and journalists around the globe gear up for the big event, six teams of American high school students are traveling to CERN April 2-7 and reporting back to their peers across the country via blogs and videos.

The 18 student journalists are witnessing the same excitement as the professional news media that have flocked to CERN in recent months, including the New York Times, National Geographic and the Discovery Channel. The six teams from five states across the U.S. were the winners of a competition sponsored and funded by the U.S. Department of Energy's Office of Science and the National Science Foundation. Each team consists of a teacher and three students who combine their expertise in physics, communications and video production.

More about the students

What is the LHC?

What are the experiments searching for?

International Cooperation and Education

Student Blogs

Centennial Sr. High School
Frank Dobie High School
Lincoln High School
Payson High School
Rush-Henrietta High School
South Houston High School

Other Blogs

QuarkNet LHC student blog
CERN Open Student Times

Student Videos

Available early June

Frank Dobie High School - Available now!
South Houston High School - Available now!
Lincoln High School - Available now!
Centennial Sr. High School - Coming soon!
Payson High School - Available now!
Rush-Henrietta High School - Coming soon!

New Particles Chart

Standard Model of

FUNDAMENTAL PARTICLES AND INTERACTIONS

The Standard Model is a quantum theory that summarizes our current knowledge of the physics of fundamental particles and fundamental interactions (interactions are manifested by forces and by decay rates of unstable particles).

FERMIONS matter constituents spin = 1/2, 3/2, 5/2, ...

Leptons spin =1/2

Flavor	Mass GeV/c²	Electric charge
ν_L lightest neutrino*	$(0–0.13)\times10^{-9}$	0
e electron	0.000511	–1
ν_M middle neutrino*	$(0.009–0.13)\times10^{-9}$	0
μ muon	0.106	–1
ν_H heaviest neutrino*	$(0.04–0.14)\times10^{-9}$	0
τ tau	1.777	–1

Quarks spin =1/2

Flavor	Approx. Mass GeV/c²	Electric charge
u up	0.002	2/3
d down	0.005	–1/3
c charm	1.3	2/3
s strange	0.1	–1/3
t top	173	2/3
b bottom	4.2	–1/3

*See the neutrino paragraph below.

Spin is the intrinsic angular momentum of particles. Spin is given in units of ħ, which is the quantum unit of angular momentum where $\hbar = h/2\pi = 6.58\times10^{-25}$ GeV s $=1.05\times10^{-34}$ J s.

Electric charges are given in units of the proton's charge. In SI units the electric charge of the proton is 1.60×10^{-19} coulombs.

The energy unit of particle physics is the electronvolt (eV), the energy gained by one electron in crossing a potential difference of one volt. **Masses** are given in GeV/c² (remember $E = mc^2$) where 1 GeV = 10^9 eV $=1.60\times10^{-10}$ joule. The mass of the proton is 0.938 GeV/c² $= 1.67\times10^{-27}$ kg.

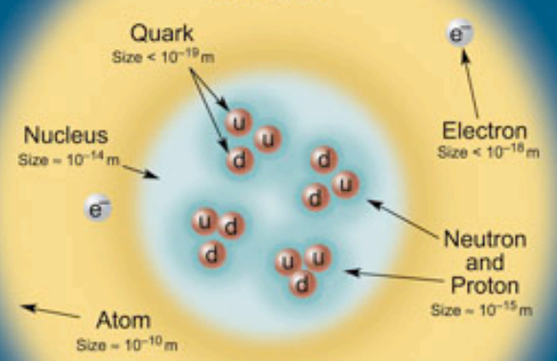
Neutrinos

Neutrinos are produced in the sun, supernovae, reactors, accelerator collisions, and many other processes. Any produced neutrino can be described as one of three neutrino flavor states ν_e, ν_μ, or ν_τ, labelled by the type of charged lepton associated with its production. Each is a defined quantum mixture of the three definite mass neutrinos ν_L, ν_M, and ν_H for which currently allowed mass ranges are shown in the table. Further exploration of the properties of neutrinos may yield powerful clues to puzzles about matter and antimatter and the evolution of stars and galaxy structures.

Matter and Antimatter

For every particle type there is a corresponding antiparticle type, denoted by a bar over the particle symbol (unless + or – charge is shown). Particle and antiparticle have identical mass and spin but opposite charges. Some electrically neutral bosons (e.g., Z^0, γ, and $\eta_c = c\bar{c}$ but not $K^0 = d\bar{s}$) are their own antiparticles.

Structure within the Atom



If the proton and neutrons in this picture were 10 cm across, then the quarks and electrons would be less than 0.1 mm in size and the entire atom would be about 10 km across.

BOSONS force carriers spin = 0,1,2, ...

Unified Electroweak spin = 1

Name	Mass GeV/c²	Electric charge
γ photon	0	0
W^-	80.39	–1
W^+ W bosons	80.39	+1
Z^0 Z boson	91.188	0

Strong (color) spin =1

Name	Mass GeV/c²	Electric charge
g gluon	0	0

Color Charge

Only quarks and gluons carry "strong charge" (also called "color charge") and can have strong interactions. Each quark carries three types of color charge. These charges have nothing to do with the colors of visible light. Just as electrically-charged particles interact by exchanging photons, in strong interactions, color-charged particles interact by exchanging gluons.

Quarks Confined in Mesons and Baryons

Quarks and gluons cannot be isolated – they are confined in color-neutral particles called hadrons. This confinement (binding) results from multiple exchanges of gluons among the color-charged constituents. As color-charged particles (quarks and gluons) move apart, the energy in the color-force field between them increases. This energy eventually is converted into additional quark-antiquark pairs. The quarks and antiquarks then combine into hadrons; these are the particles seen to emerge.

Two types of hadrons have been observed in nature **mesons** $q\bar{q}$ and **baryons** qqq. Among the many types of baryons observed are the proton (uud), antiproton ($\bar{u}\bar{u}\bar{d}$), neutron (udd), lambda Λ (uds), and omega Ω^- (sss). Quark charges add in such a way as to make the proton have charge 1 and the neutron charge 0. Among the many types of mesons are the pion π^+ ($u\bar{d}$), kaon K^- ($s\bar{u}$), B^0 ($d\bar{b}$), and η_c ($c\bar{c}$). Their charges are +1, 1, 0, 0 respectively.

Properties of the Interactions

The strengths of the interactions (forces) are shown relative to the strength of the electromagnetic force for two u quarks separated by the specified distances.

Property	Gravitational Interaction	Weak Interaction (Electroweak)	Electromagnetic Interaction	Strong Interaction
Acts on:	Mass – Energy	Flavor	Electric Charge	Color Charge
Particles experiencing:	All	Quarks, Leptons	Electrically Charged	Quarks, Gluons
Particles mediating:	Graviton (not yet observed)	W^+ W^- Z^0	γ	Gluons
Strength at 10^{-18} m	10^{-41}	0.8	1	25
Strength at 3×10^{-17} m	10^{-41}	10^{-4}	1	60

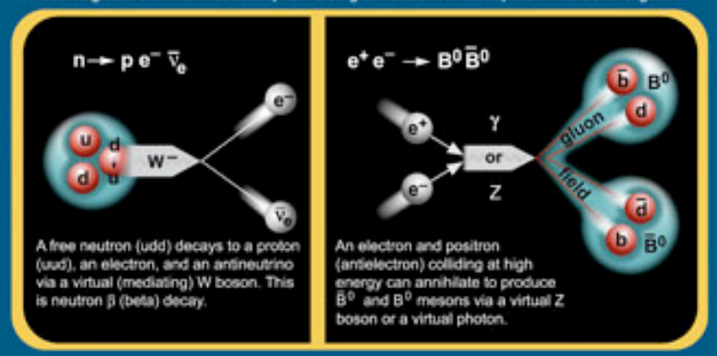
Visit the award-winning web feature *The Particle Adventure* at

ParticleAdventure.org

This chart has been made possible by the generous support of:
U.S. Department of Energy
U.S. National Science Foundation
Lawrence Berkeley National Laboratory

Particle Processes

These diagrams are an artist's conception. Blue-green shaded areas represent the cloud of gluons.



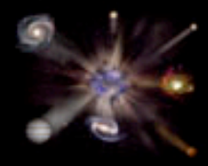
A free neutron (udd) decays to a proton (uud), an electron, and an antineutrino via a virtual (mediating) W boson. This is neutron β (beta) decay.

An electron and positron (antielectron) colliding at high energy can annihilate to produce B^0 and $\bar{B}^0$ mesons via a virtual Z boson or a virtual photon.

Unsolved Mysteries

Driven by new puzzles in our understanding of the physical world, particle physicists are following paths to new wonders and startling discoveries. Experiments may even find extra dimensions of space, mini-black holes, and/or evidence of string theory.

Universe Accelerating?



The expansion of the universe appears to be accelerating. Is this due to Einstein's Cosmological Constant? If not, will experiments reveal a new force of nature or even extra (hidden) dimensions of space?

Why No Antimatter?

Matter and antimatter were created in the Big Bang. Why do we now see only matter except for the tiny amounts of antimatter that we make in the lab and observe in cosmic rays?

Dark Matter?

Invisible forms of matter make up much of the mass observed in galaxies and clusters of galaxies. Does this dark matter consist of new types of particles that interact very weakly with ordinary matter?

Origin of Mass?

In the Standard Model, for fundamental particles to have masses, there must exist a particle called the Higgs boson. Will it be discovered soon? Is supersymmetry theory correct in predicting more than one type of Higgs?

Particles Chart on prime time TV

Big Bang Theory

The Big Bang Theory - The Bat Jar Conjecture

Since Sheldon's only focus is to prove his mental superiority while preparing for the Physics Bowl, the guys kick him off the the team and enlist his nemesis Leslie Winkle.

6 million hits per year on LBNL site only,

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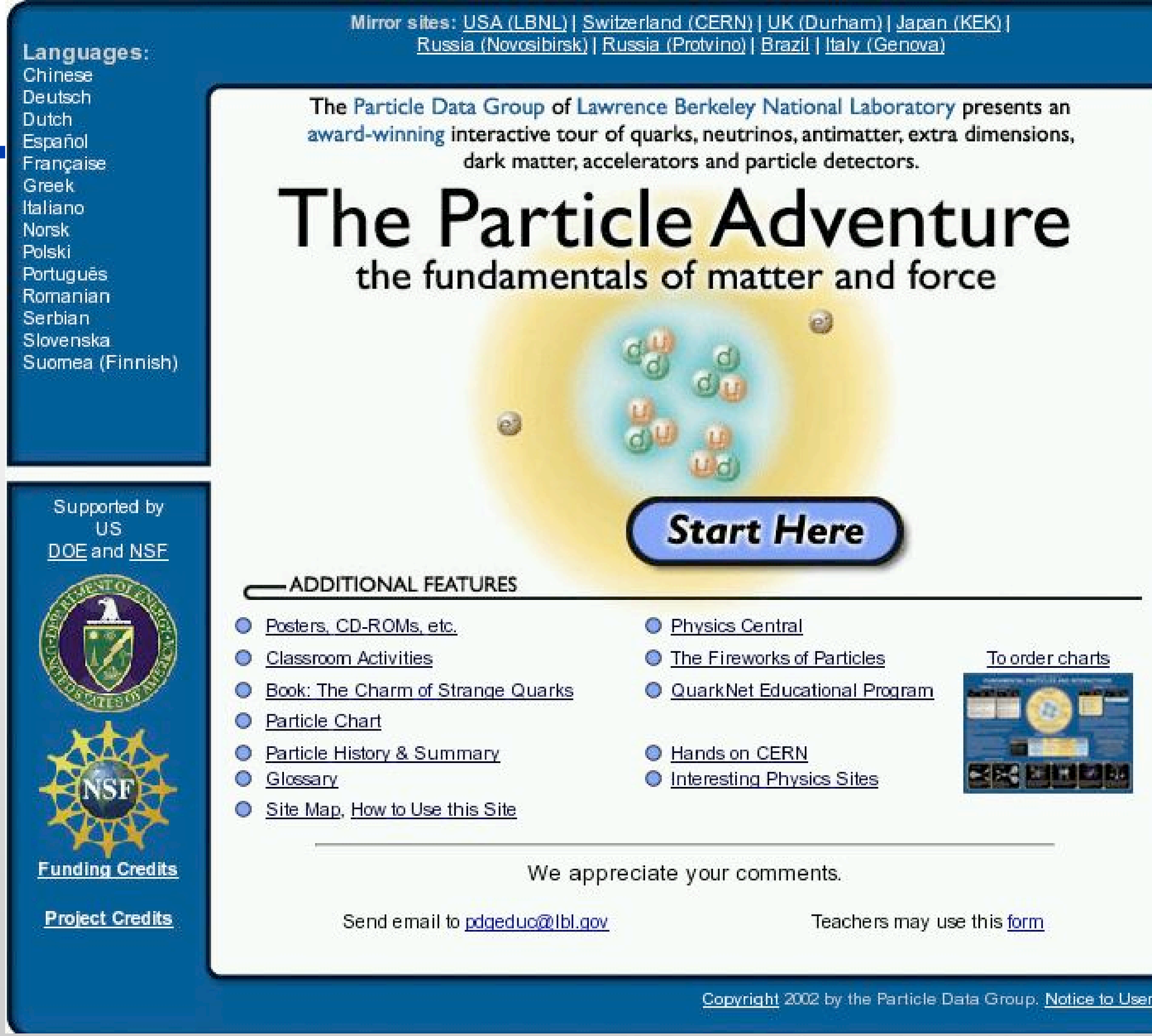


Example of Recognition

SCIENTIFIC AMERICAN

Main Menu | Interview | Bookmarks | Feedback
Current Issue | Explore! | Ask the Experts | Marketplace | Search the Site

EXPLORE!

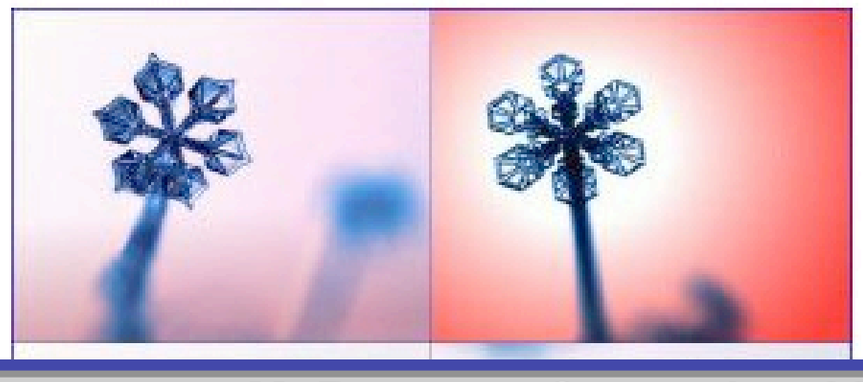
Physics

The Particle Adventure

If you?ve ever wondered what the heck quarks and neutrinos are, or why anyone cares, this is the site for you. Lawrence Berkeley National Laboratory?s particle physicists have created an accessible, entertaining primer on, as they describe it, what the world is made of and what holds it together. Nine sections address these fundamental questions and explore related topics, such as how researchers collect and interpret particle data, and how particles decay into other particles. One not–to–be–missed chapter covers unsolved mysteries, delving into supersymmetry, string theory, dark matter and the possible existence of extra dimensions. Other features include particle physics news and a page of links to other particle physics education sites.

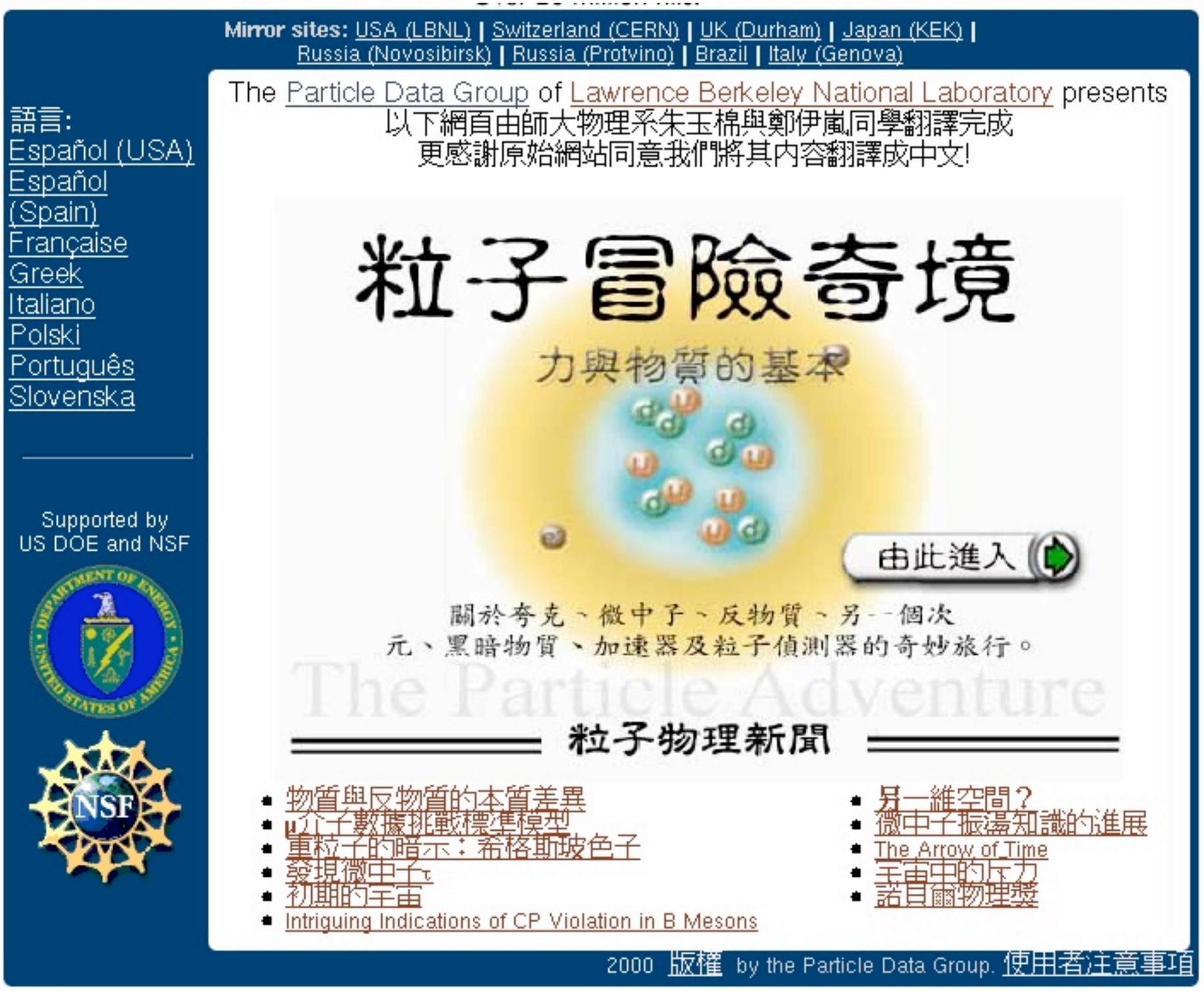
Snow Crystals

A visit to this site might help you appreciate the season's flakes next time you're out shoveling them away. The author, California Institute of Technology professor Ken Libbrecht, explains everything you ever wanted to know–and then some–about natural snow, lab–made designer crystals and the physics behind them in a clear,



Chinese Version

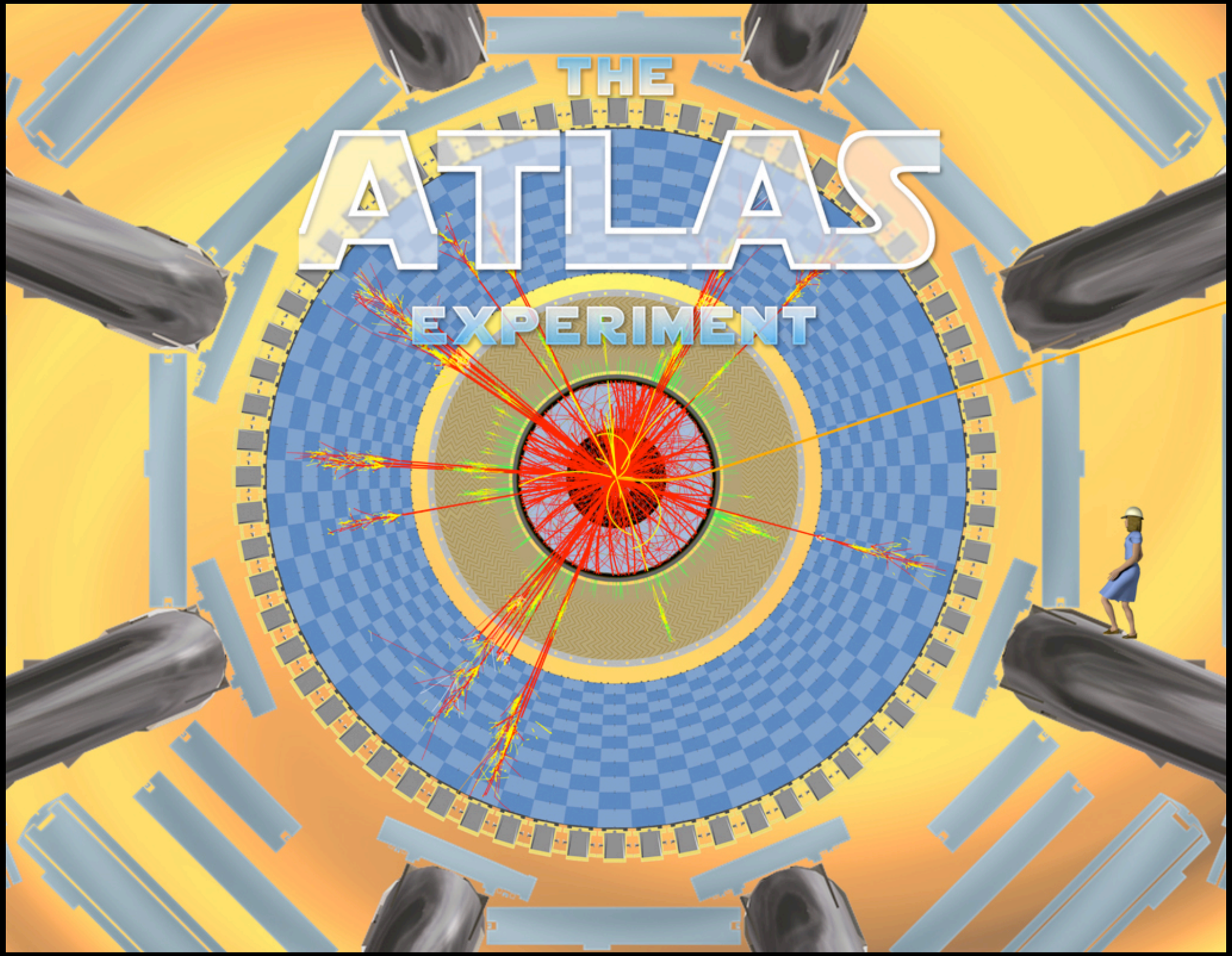
Translate Text, Images, Flash & Site map (~200 pages)



LHC has Started!

Protons have been sent into LHC and through sectors.

Stephen Hawking at the LHC


THE
ATLAS
EXPERIMENT

PDG particle data group

DOE Review

ATLAS Outreach Photos/Images

BERKELEY LAB

ATLAS Projects include
(recently completed or under devel):

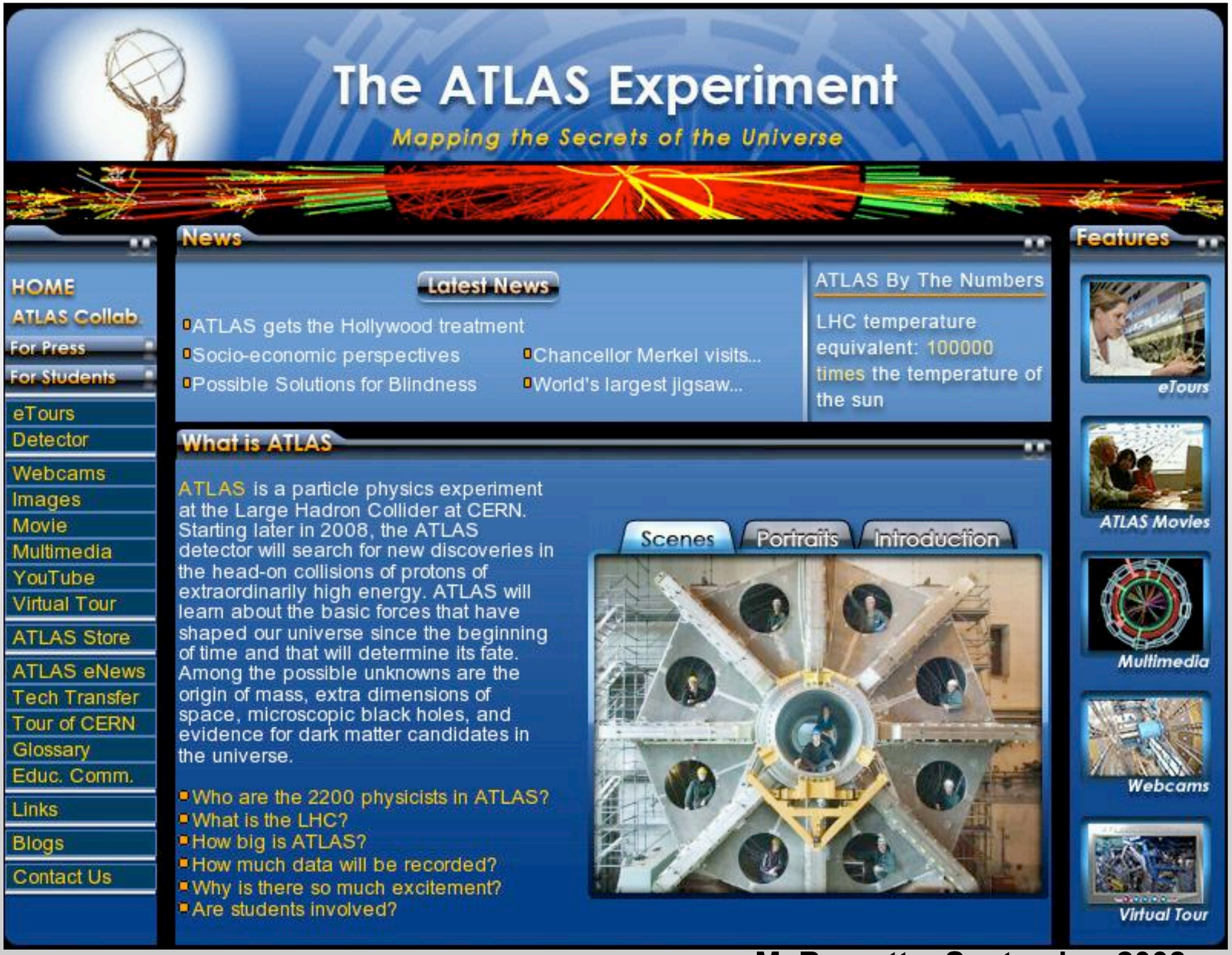
- Animated Video clips
- Real-life Video clips
- Web listing of stories in the newsmedia about ATLAS
- Latest ATLAS news headlines
- Animated features (Episodes I and II on a DVD with the ATLAS Movie)
- Press Kit
- Webpages for the newsmedia
- Best photos and images of ATLAS webpages
- Brochure (and webpage) on applications of work on ATLAS
- Brochure (and webpage) on the physics of ATLAS
- ATLAS fact sheets and webpages
- ATLAS exhibit in Bldg. SX1 (over the ATLAS cavern)
- Special events such as Open Day
- Program of high school student event analysis
- Masterclasses for high school students
- Andrew Millington movie (former BBC producer)

ATLAS products

- Brochures
- Press Kit
- Posters
- DVDs
- The ATLAS book
- 3D Viewer of detector
- Puzzle with 500 pieces
- T-shirts, hats, jackets

http://ATLAS.ch

Public webpages



ATLAS on YouTube

YouTube.com/TheATLASExperiment

18 videos.

Top one has 40,000 viewings.

Total is over 165,000 viewings.

Also on: http://atlas.ch

The ATLAS Experiment

Mapping the Secrets of the Universe

http://atlas.ch

The ATLAS Experiment

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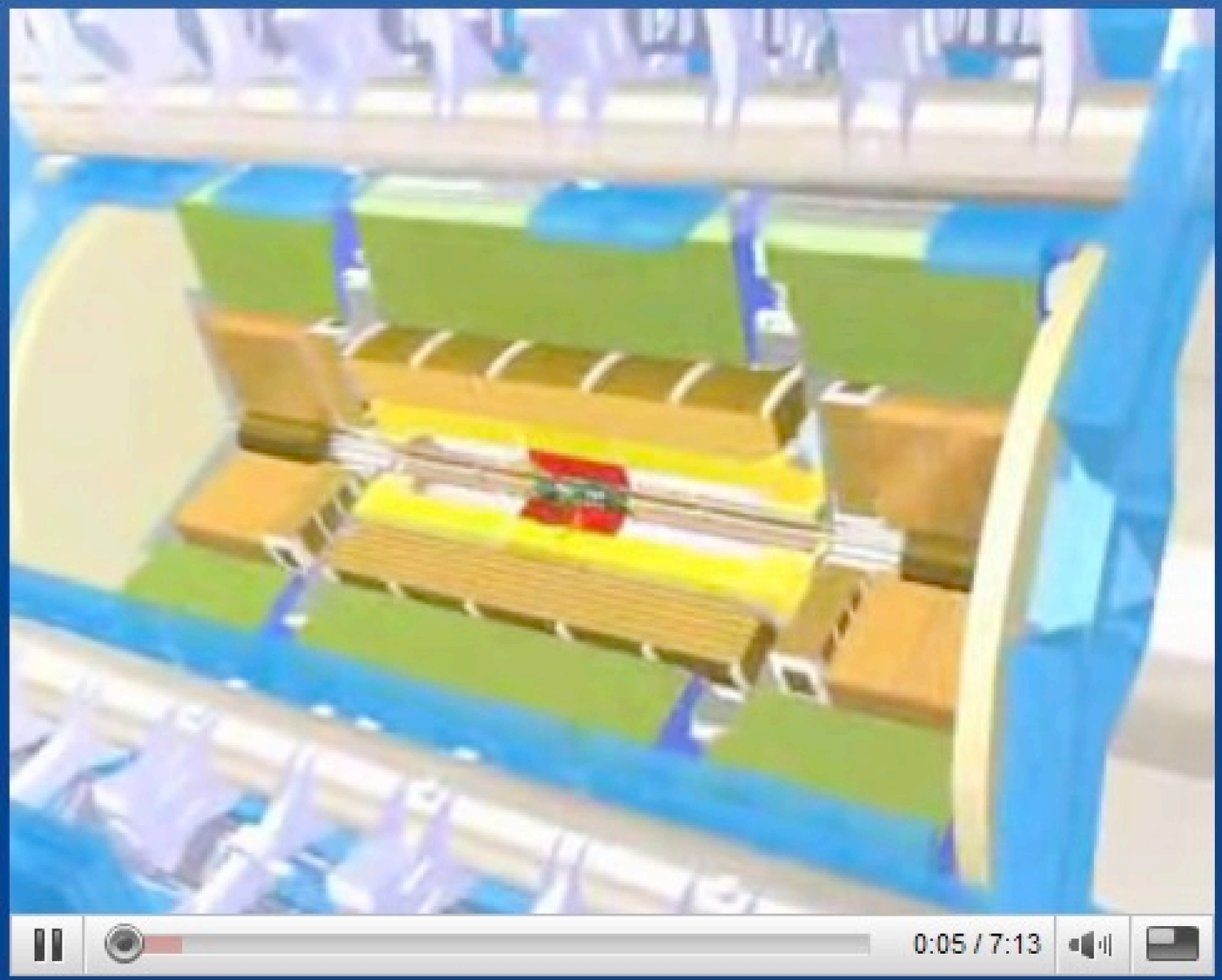
DIRECTOR

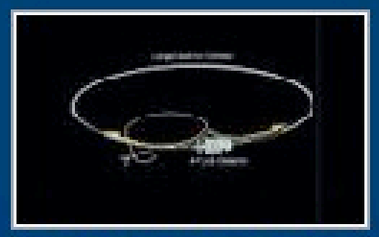
ATLAS is a particle physics experiment that will explore the fundamental nature of matter and the basic forces that shape our universe. Starting in late-2008, the ATLAS detector will search for new discoveries in the head-on collisions of protons of extraordinarily high energy. ATLAS is one of the largest collaborative efforts ever attempted in the physical sciences. There are 2500 physicists (Including 700 students) participating from more than 169 universities and laboratories in 37 countries.

Visit http://atlas.ch

Name: **ATLAS**

City: **Geneva**





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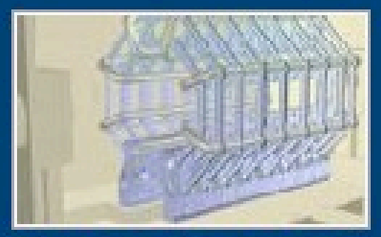

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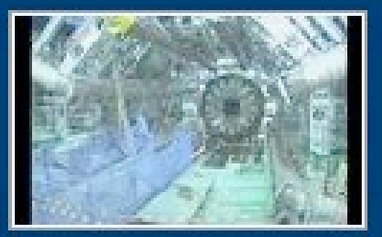

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The things that it discovers…

Notice the views in 15 days, and the highest possible ratings.

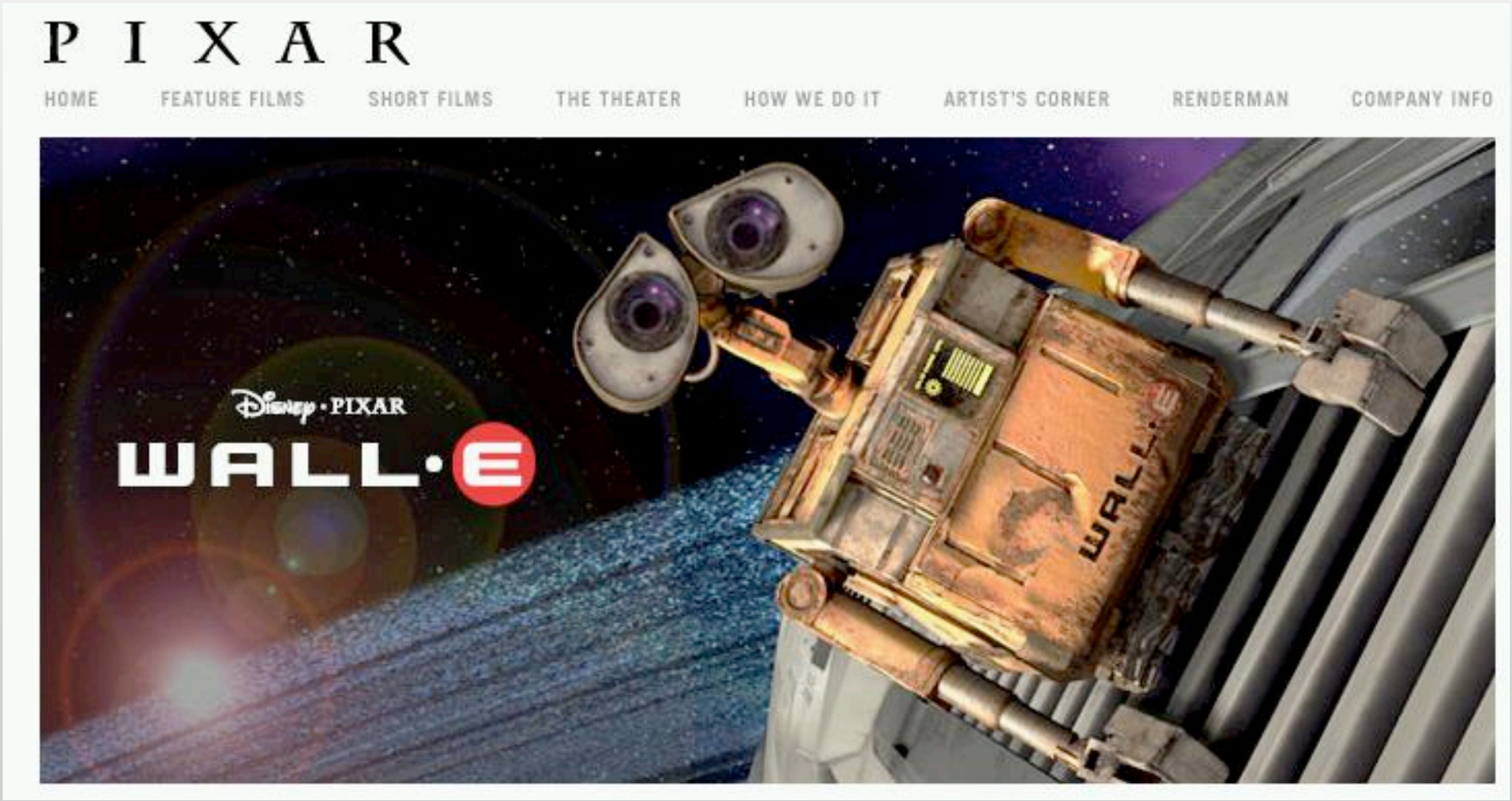
Now 700,000 viewings!

Featured on CNN and NY Times

Close Encounters with the Universe

LHC Awareness funds used to make animated film about the "Discovery Physics of the LHC"

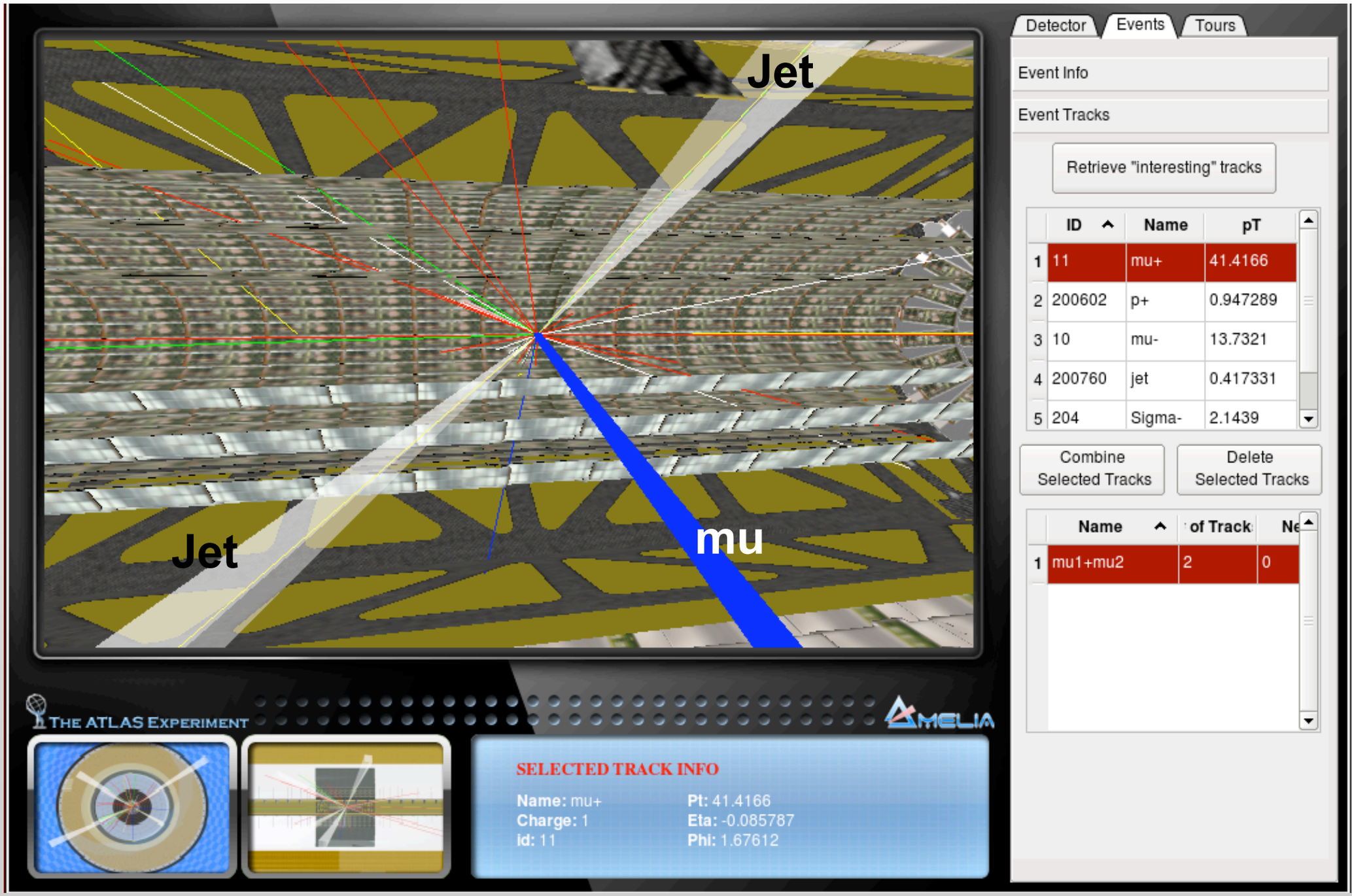
Pixar has an advisory role.



Student Event Analysis (AMELIA)

Interactive event analysis for students and public

ATLAS Multimedia Educational Lab for Interactive Analysis



The End