CERN Education Programmes

Rolf Landua

CERN
Research Physicist (Antimatter)
Head of Education

Overview

Overview

What are the goals ?

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What are the goals ?

What makes CERN attractive ?

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Communication vs Education

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What is our approach?

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Polish teachers at CERN

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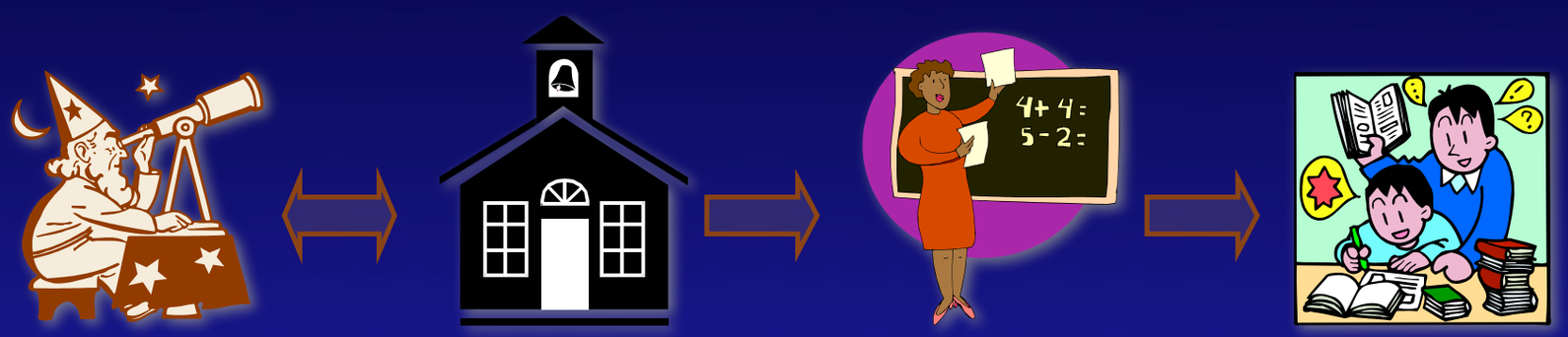
EIROForum - CERN activities

1) Goals of CERN Teacher Education

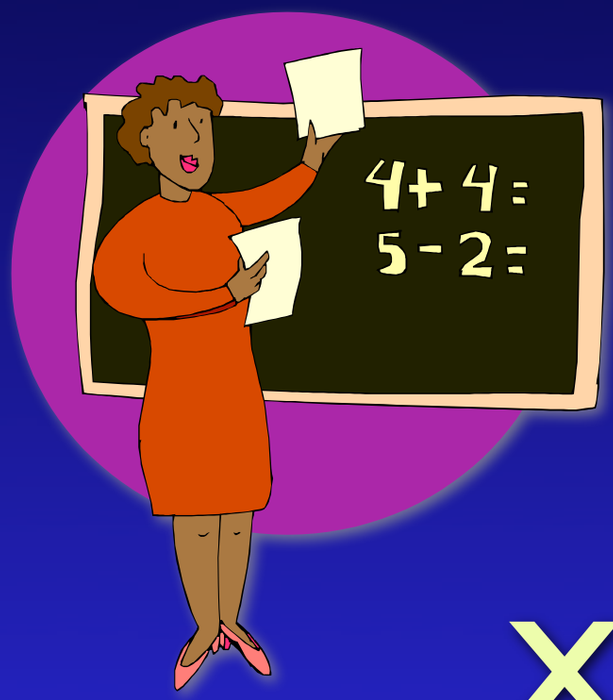


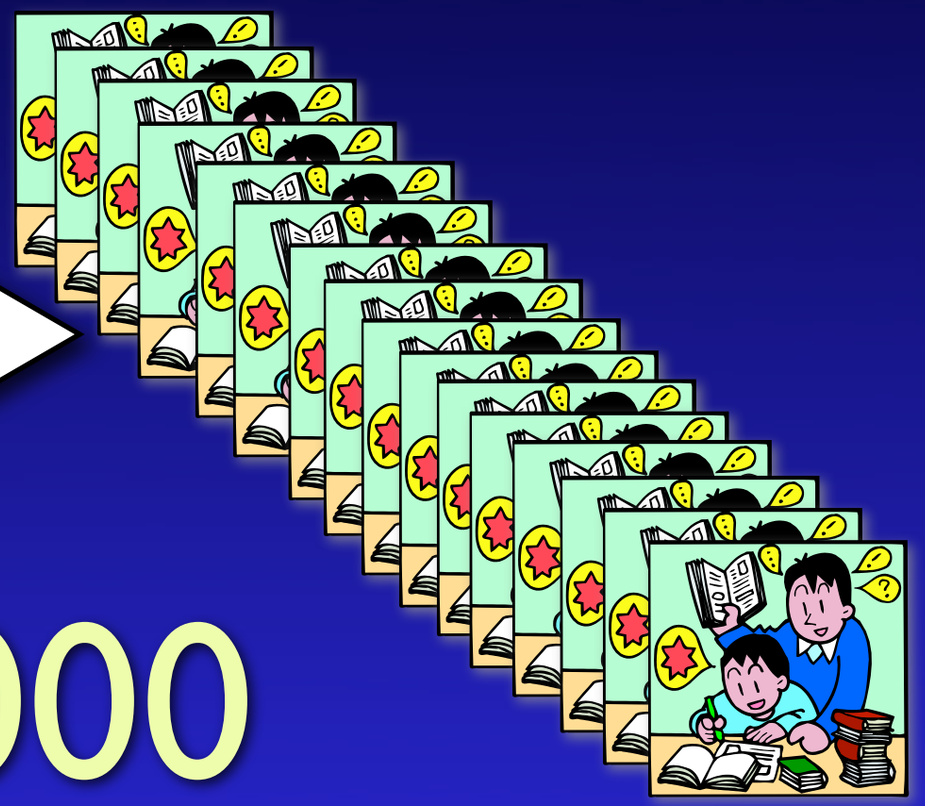
Research | University | School Teacher | Students

Bring modern science into schools

Teachers are the crucial link

Teachers are multipliers





x 1000

School Teacher

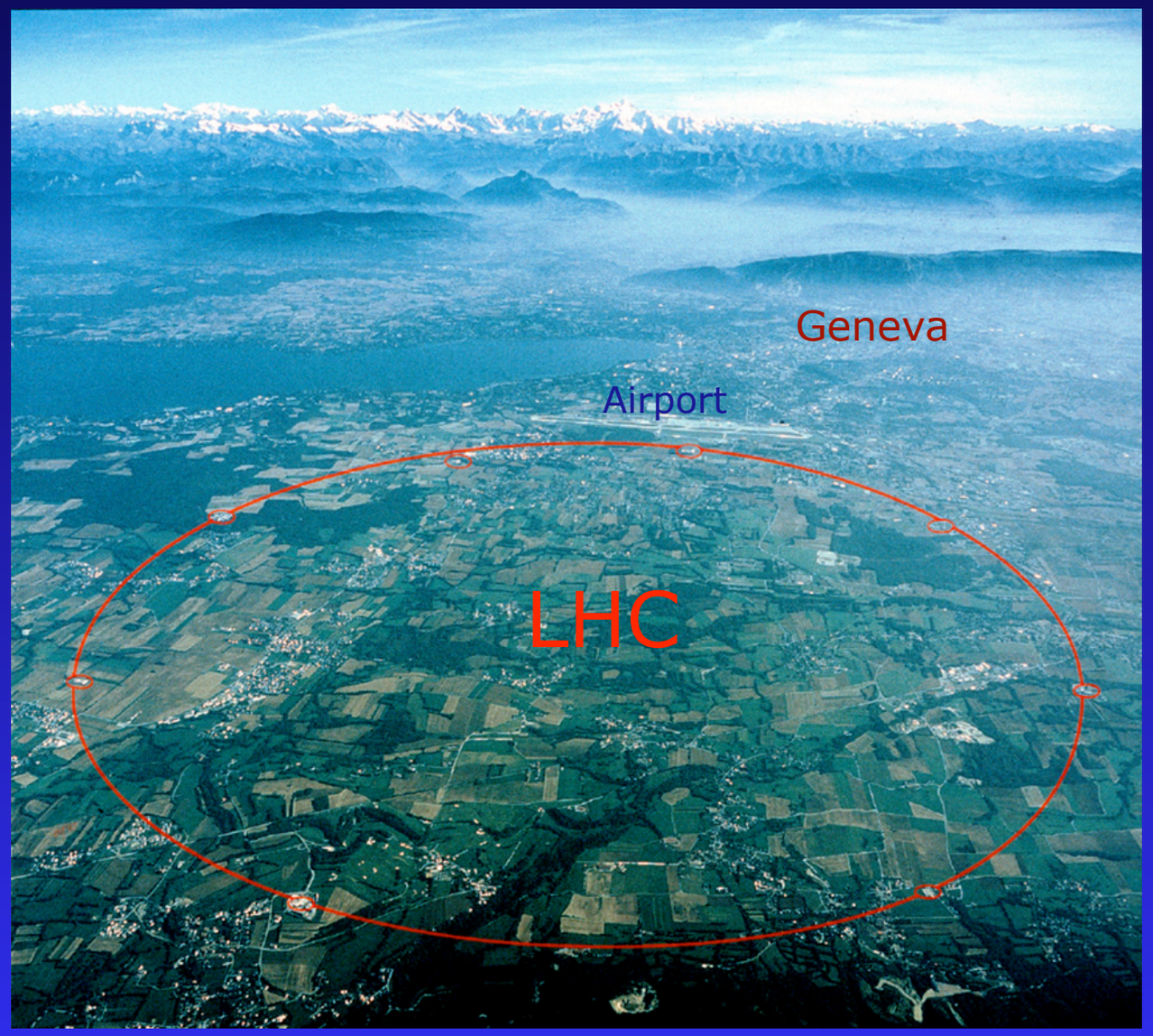
School Students

2) What makes CERN attractive ?

Largest science laboratory in the world

The largest particle accelerator in history - the LHC

The LHC will produce particles that existed only shortly after the Big Bang



Big questions …

To understand how the laws of Nature evolved

To understand the evolution of matter and of the Universe

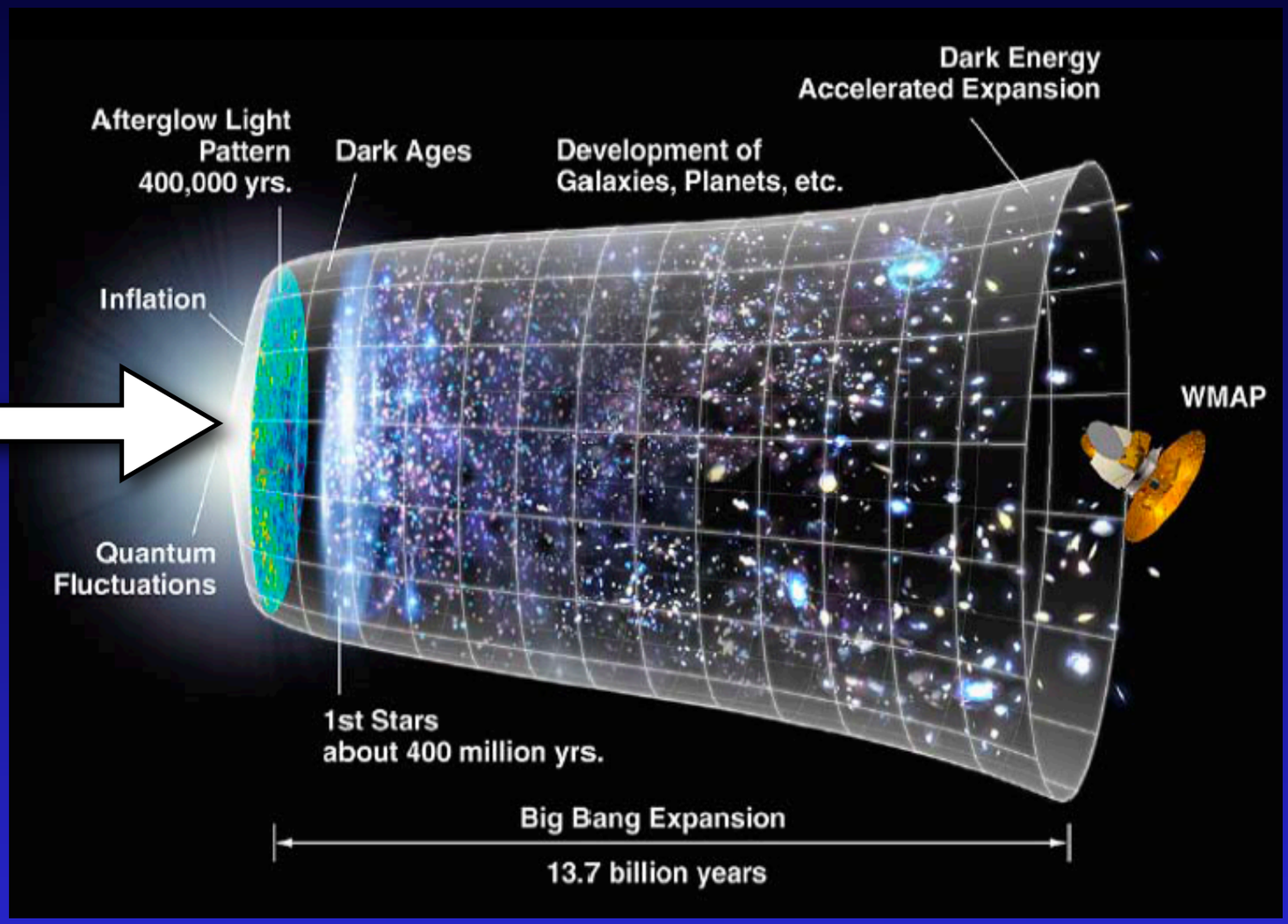
… for the whole world

CERN provides infrastructure and tools for physicists world-wide (> 100 countries) collaborating peacefully

How science works

Theories .....

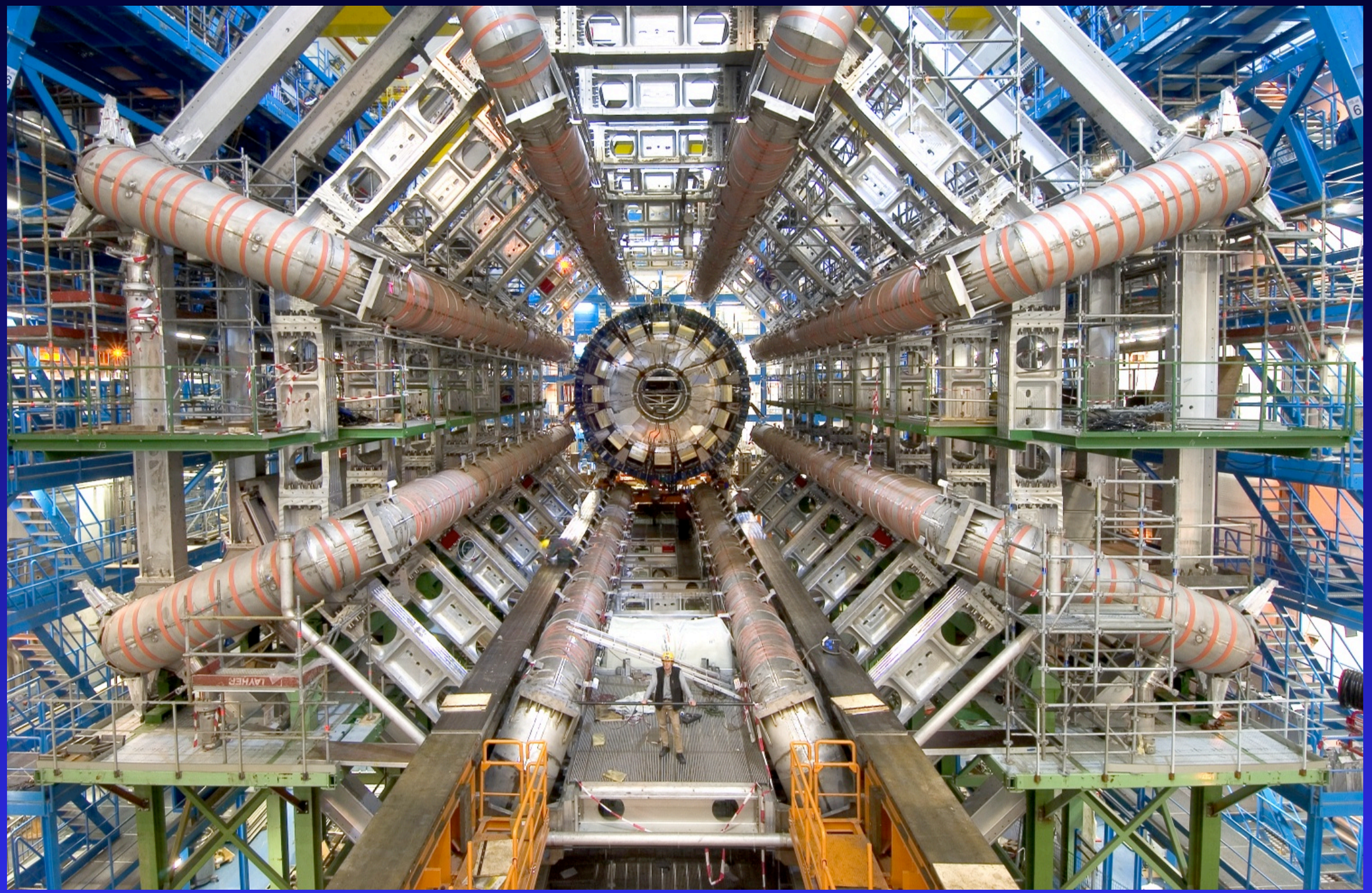
- origin of mass
- Dark matter
- extra-dimensions



...are tested experimentally by reproducing conditions

~ 10^{-12} sec after the Big Bang

CERN dimensions are huge



3) Communication vs Education

CERN has a broad range of communication activities

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> 800 media visits per year (TV, newspapers, radio)

Visitor programme (60,000 visit requests - 25,000 accepted - 50 % schools)

Permanent and temporary exhibitions (Microcosm, soon: 'Globe')

Open day (2004: 30,000 visitors; 6 April 2008:> 40,000 visitors)

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short, punctual 'information' (snapshots)

… not to be confused with 'education'

CERN Education Activities

Scientists at CERN

Academic Training Programme

Young researchers

CERN School of High Energy Physics

CERN School of Computing

CERN Accelerator School

Physics Students

Summer Students Programme

TEACHERS

CERN Teacher Schools

4) What approach for teachers (and students) ?

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RAISE INTEREST OF STUDENTS IN MODERN SCIENCE -

Motivate them to continue scientific education at school
Help them to better understand the physical world
*(**Scientific literacy**) (>95 % of students)*

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Motivate them to take up physics at universities
*(**Future generation of researchers**) (< 5 % of students)*

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PHYSICS IS ... ALIVE !

A metaphore ...

How researchers view science

How school students view science

How school students view science

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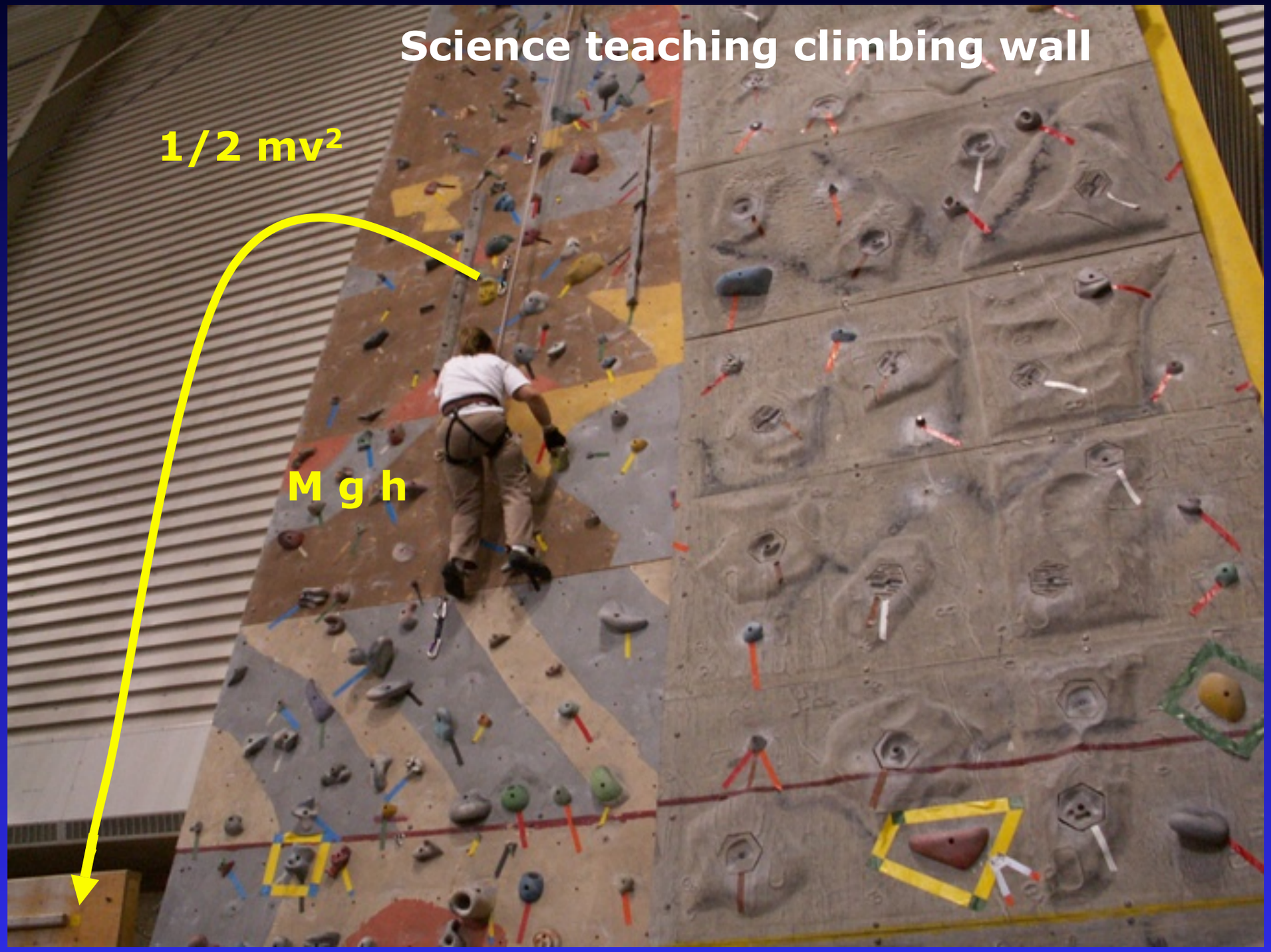
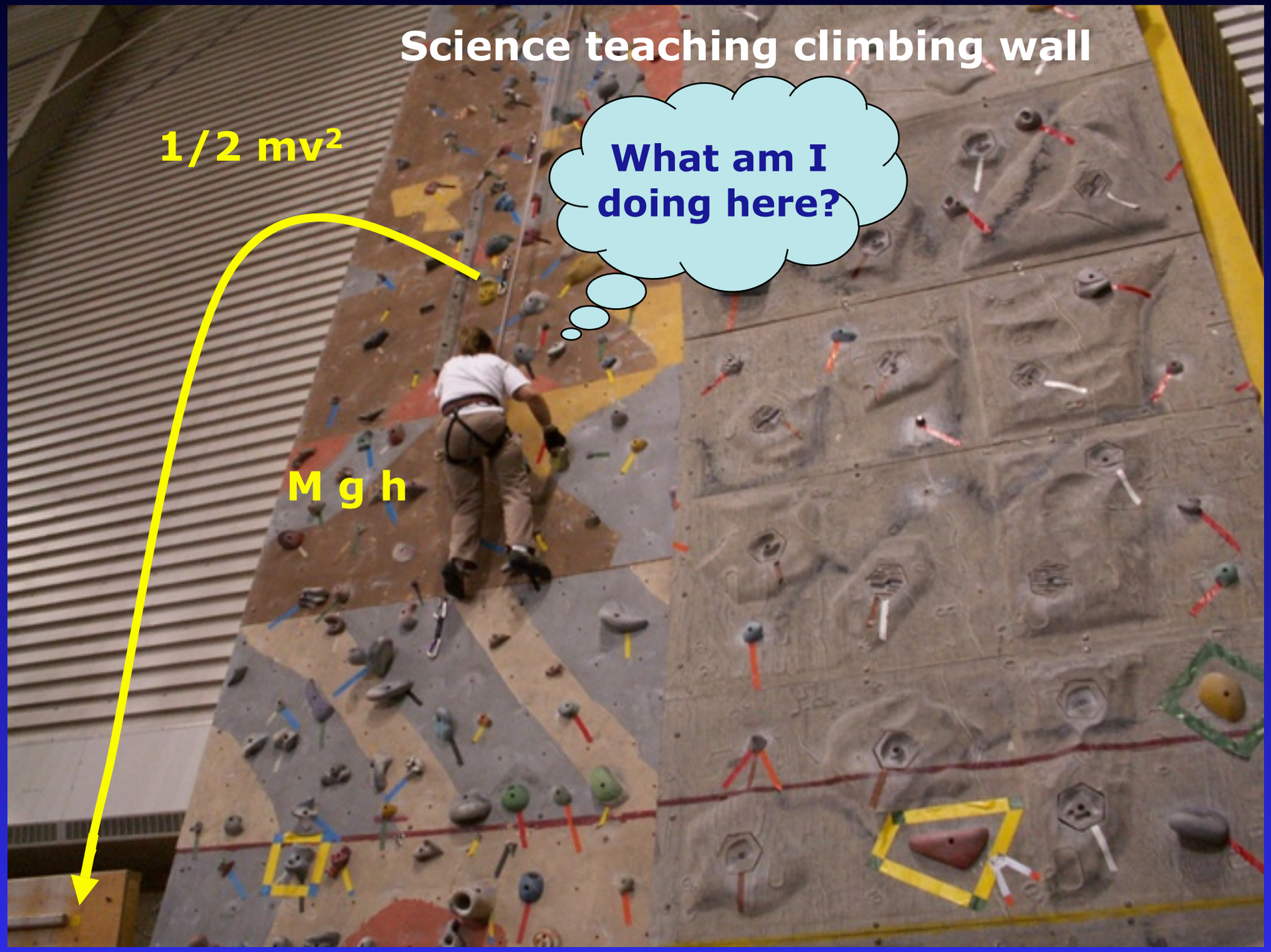
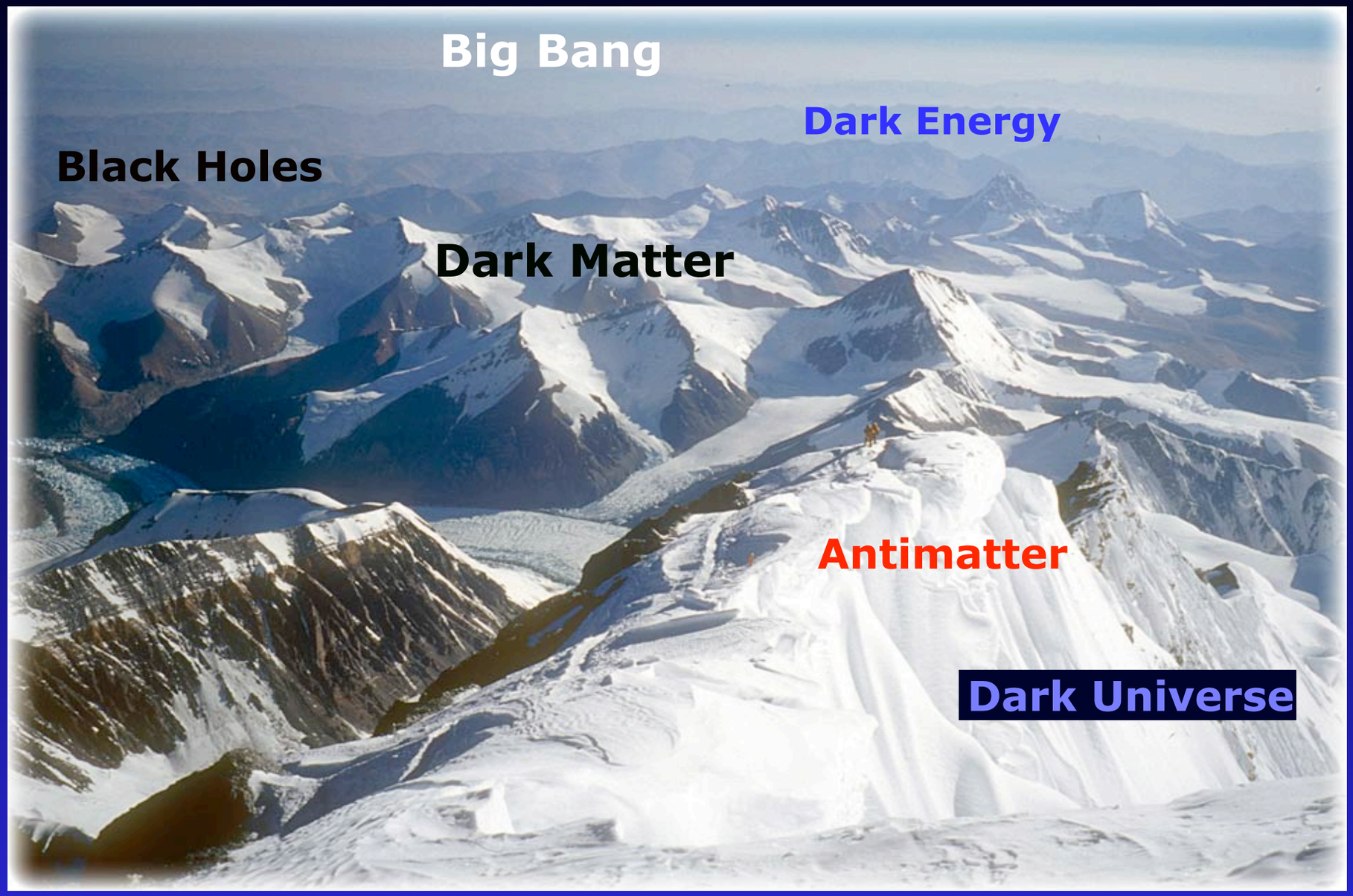


How school students view science



Take students on a sight-seeing tour …



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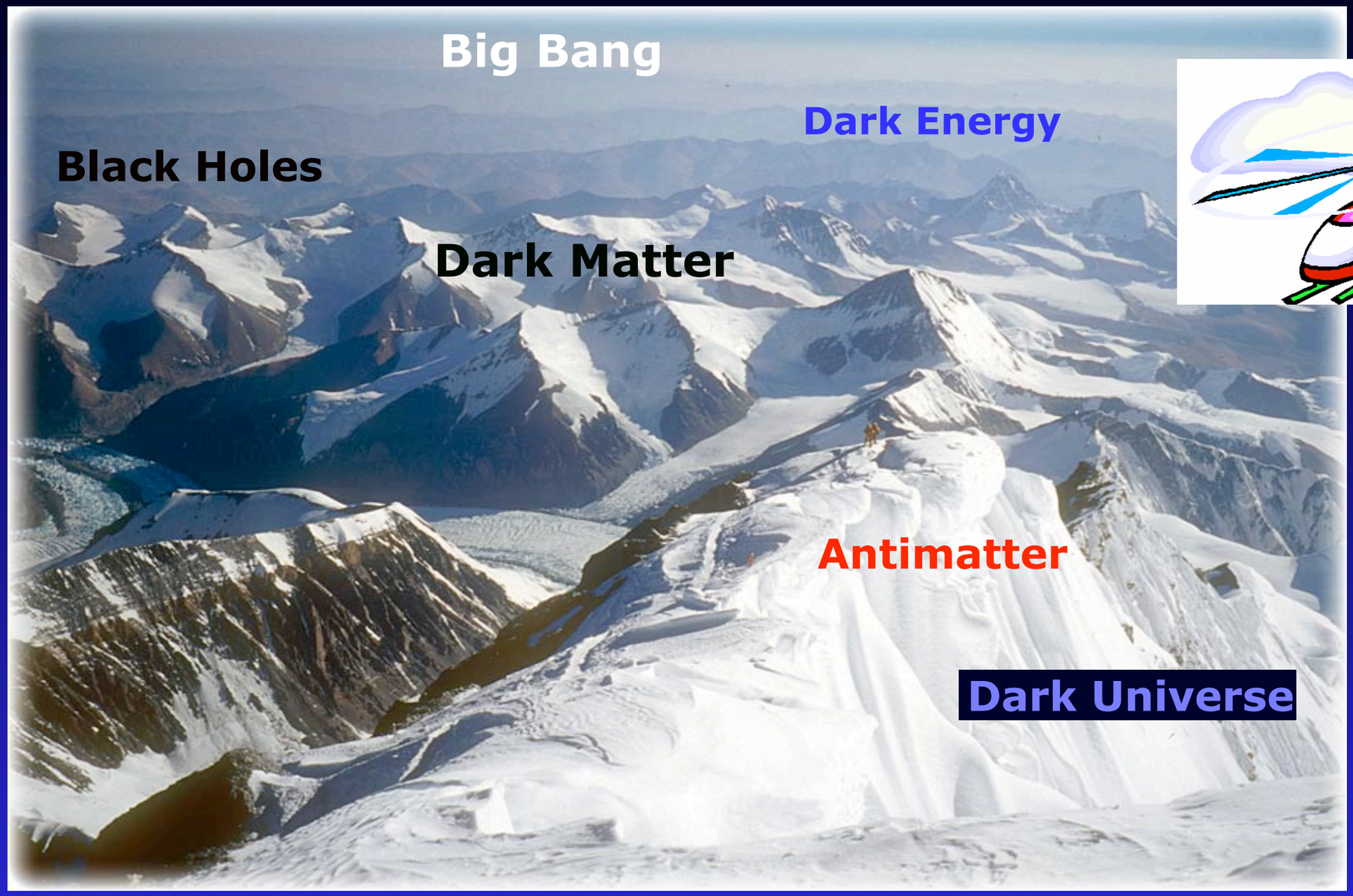

Take students on a sight-seeing tour …

Big Bang

Dark Energy

Black Holes

Dark Matter

Antimatter

Dark Universe

180,000 copies per month

Take students on a sight-seeing tour …

Use modern physics to inspire and motivate school teachers (and their students):

1) Contact with frontier science (self-confidence, develop/exchange ideas)

*2) Increase attractiveness of science lessons (**13-15 yrs**)*

5) CERN teacher programmes

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International “High School Teacher” school (3 weeks)

Fully funded by CERN for MS participants (programme, travel, accommodation)

Participants from US, Asia, South America (HELEN) funded externally

In English

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National schools (1 week)

In their mother tongue (speakers from the national science community)
External funding of travel, accommodation
Build networks between teachers and with scientists inside country

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External funding of travel, accommodation
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International weekend schools (3 days)

Partially funded by CERN for MS participants (programme, accommodation)
In English

Content of CERN Teacher Schools

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Lectures:

Particle Physics

Cosmology

Accelerators (LHC)

Detectors

Applications (IT, Medicine)

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Guided tours:

LHC experiments

Antimatter factory (AD)

PS/LEIR

CLIC

Computing Centre - GRID

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CLIC

Computing Centre - GRID

Activities:

Interactive teacher lab

Educational Resources

Games, Quiz

Lesson reviews (Q+A)

2007: 20 CERN Teacher Schools

Participants from	Number	Date
Europe, World (HST,3 wk)	43	2 - 21/ 7 / 2007
Europe (PhT, 3 d)	50	March 2007
UK (Science Learning Centres, 3d)	48	10 - 13 / 4 / 2007
Poland (2 schools)	**83**	**April, May 2007**
Slovak Republic	44	22 - 28 / 4 / 2007
Finland (4 schools)	62	April, June 2007
Germany (3 schools)	120	June, Sep, Oct 2007
Spain (Catalonia)	40	22 - 28 / 7 / 2007
Hungary	40	19 - 25 / 8 / 2007
Portugal	40	9 - 15 / 9 / 2007
Denmark	30	21 - 26 / 10 / 2007
UK (Science Learning Centres, 3d)	26	23 - 26 / 10 / 2007
Norway	40	12 - 16 / 11 / 2007
Poland	**40**	**26 - 30 / 11 /2007**

706 teachers

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Preview 2008: ~25 CERN Teacher Schools, ~1000 participants

6) Polish Quantum Step

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From 3 to 120 per year

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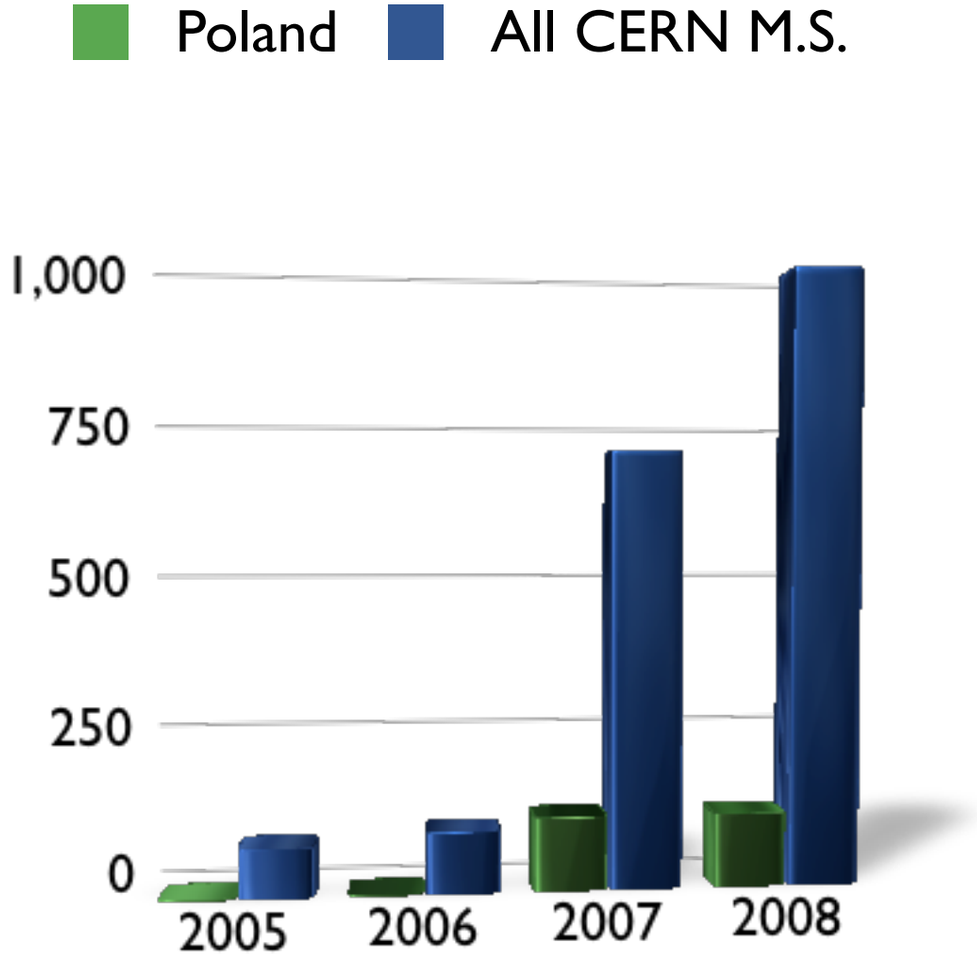


From 3 to 120 per year

More than 12% of all participants

Partners

Polish
teacher
community

Partners

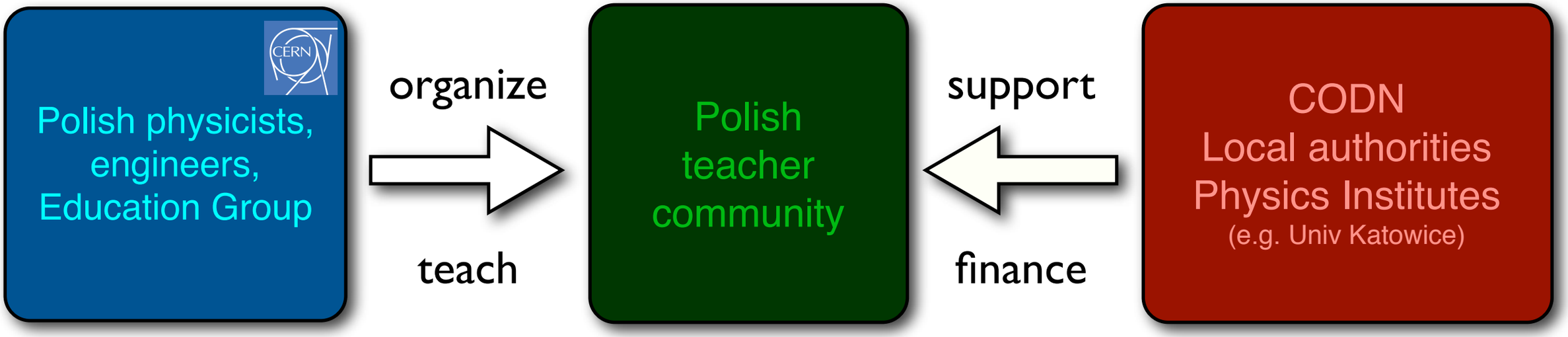
Polish physicists, engineers, Education Group

organize

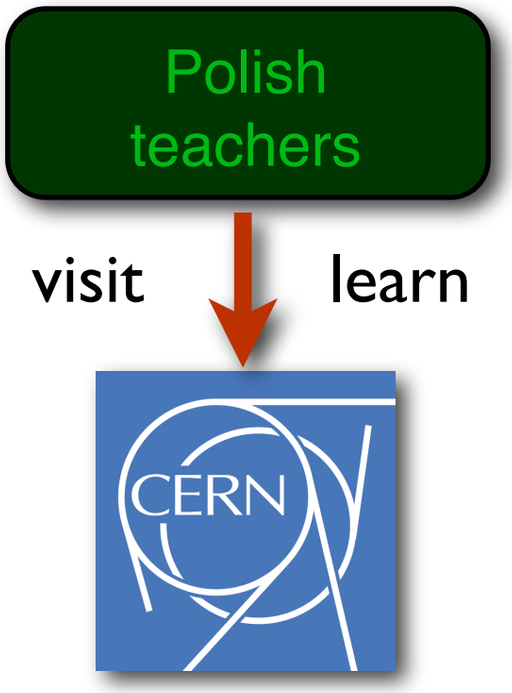
teach

Polish teacher community

Partners


CERN
Polish physicists, engineers, Education Group
organize
teach
Polish teacher community
support
finance
CODN
Local authorities
Physics Institutes
(e.g. Univ Katowice)

Follow-up



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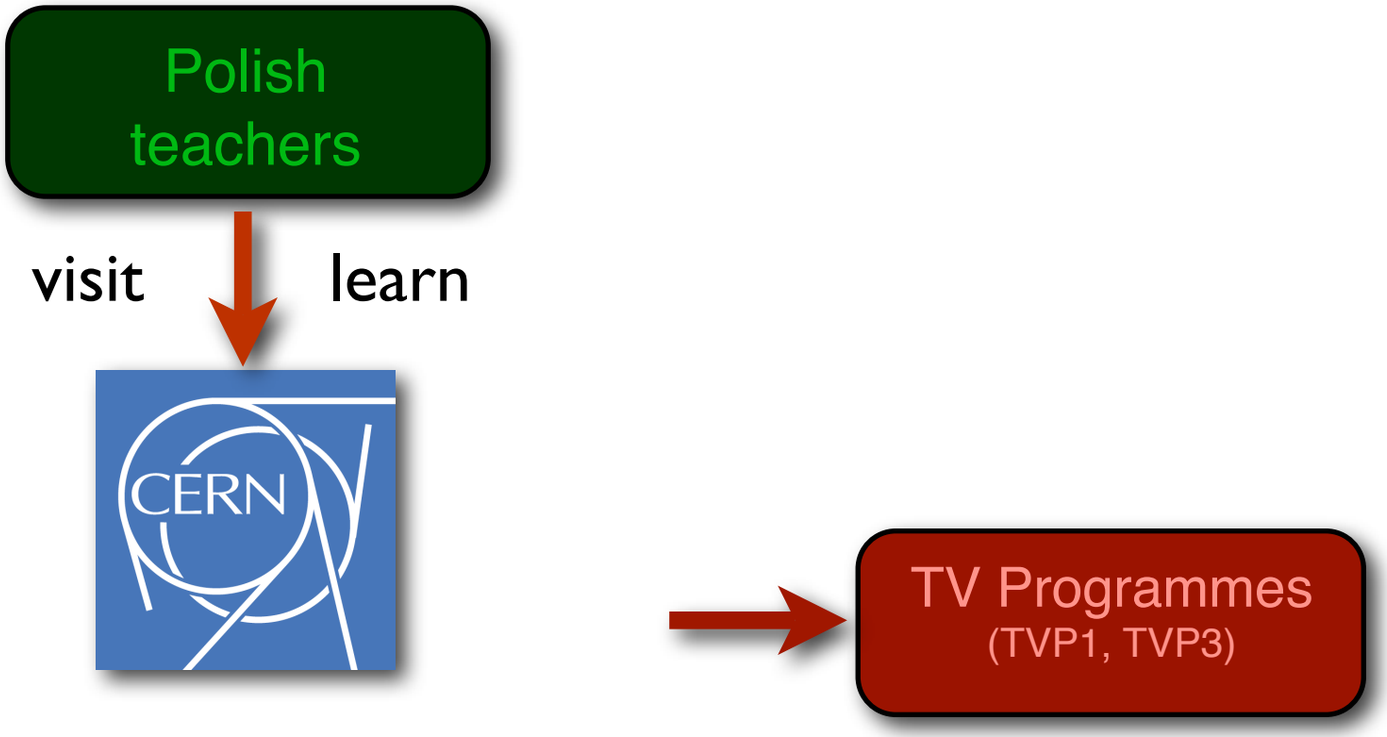

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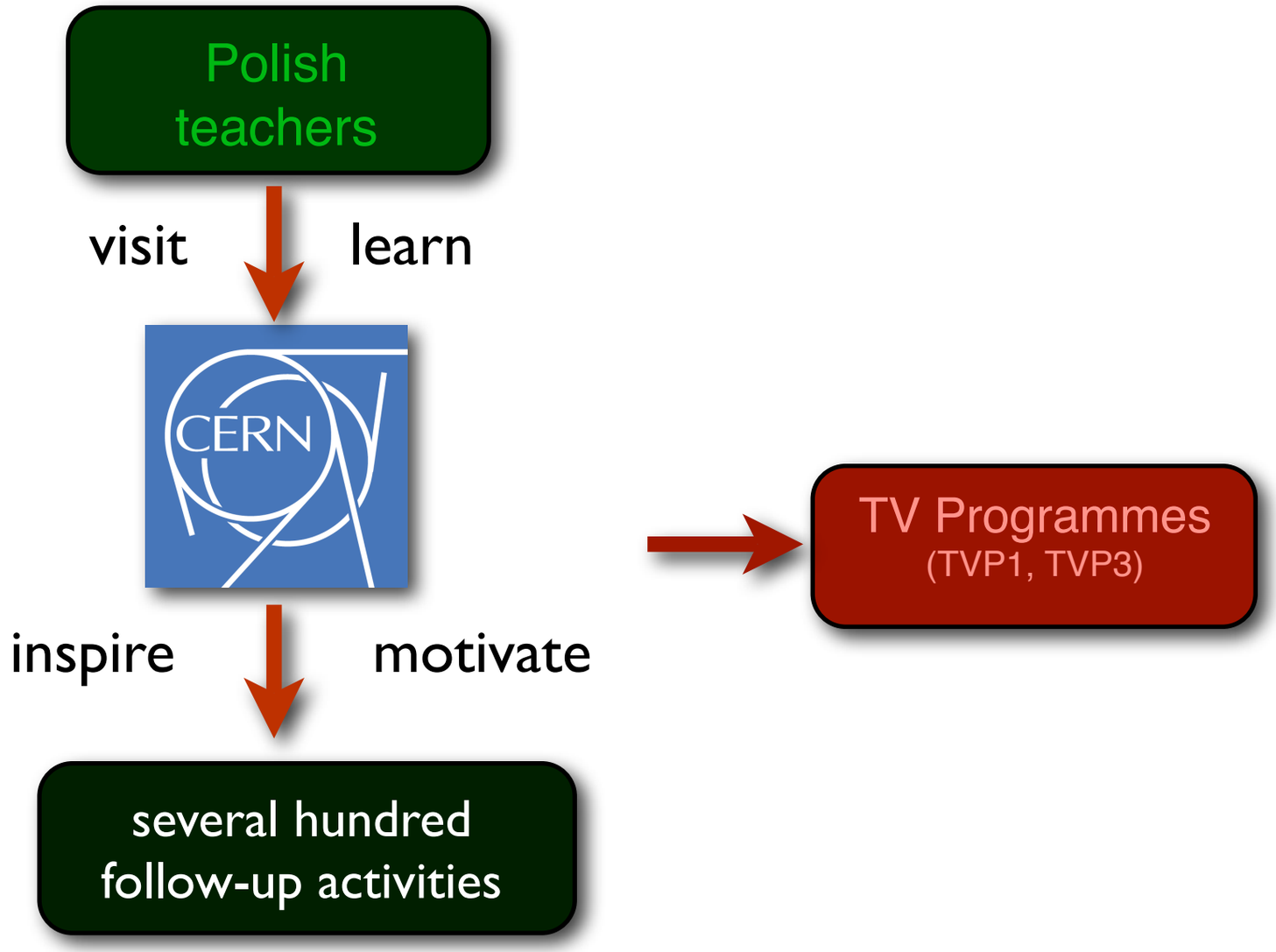
Polish teachers
visit
learn
CERN
TV Programmes
(TVP1, TVP3)
inspire
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several hundred follow-up activities

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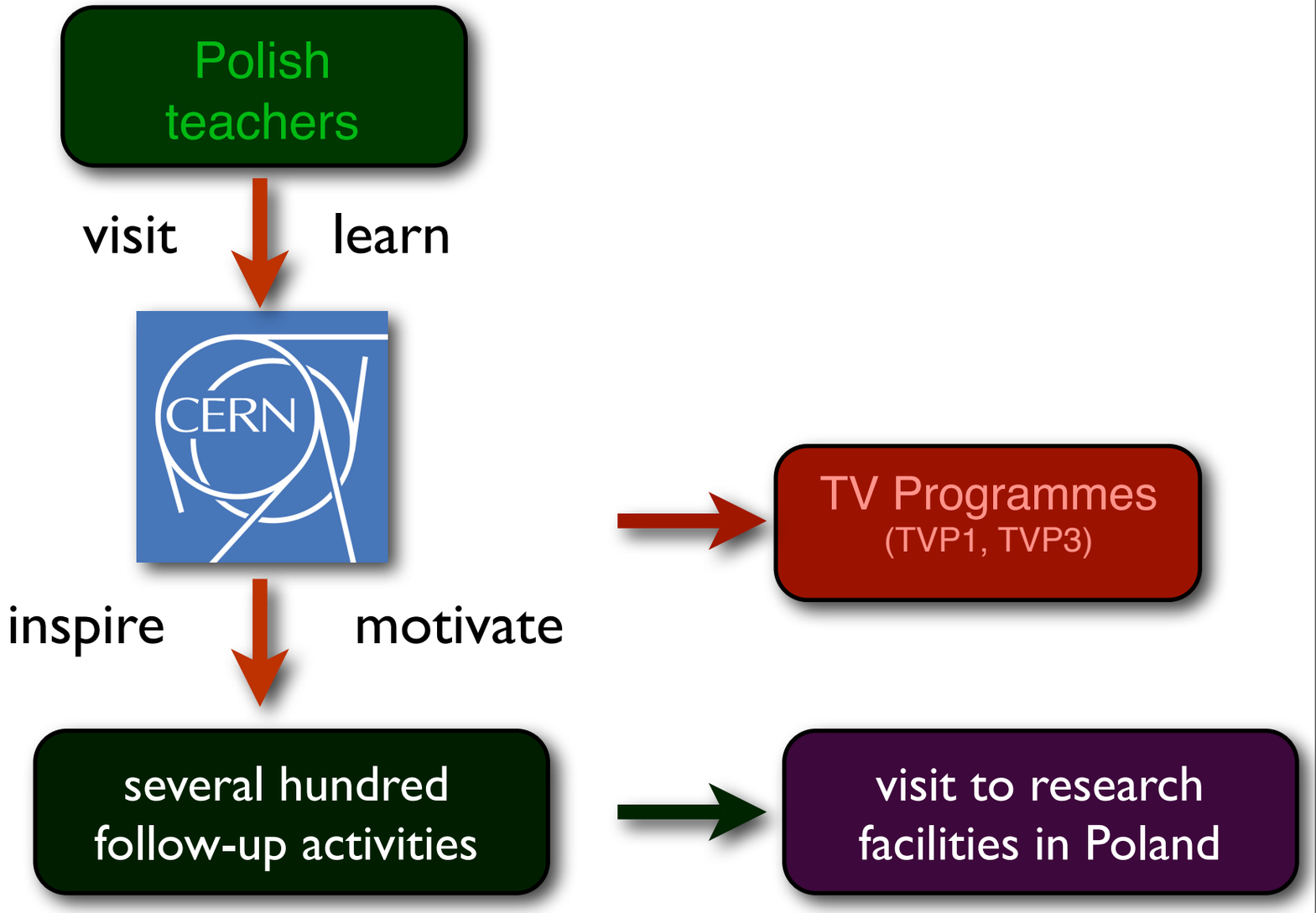
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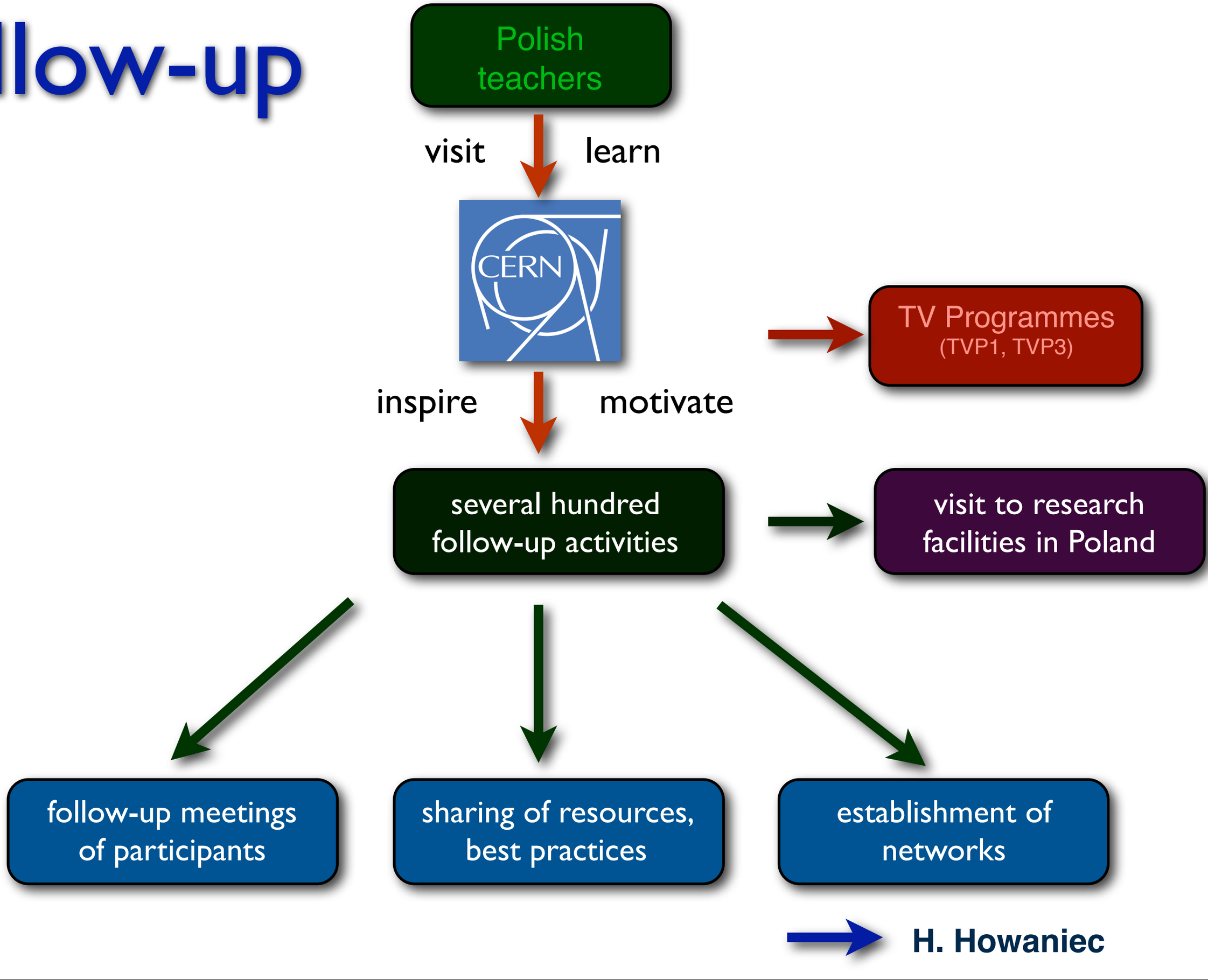

Polish teachers
visit
learn
CERN
TV Programmes (TVP1, TVP3)
inspire
motivate
several hundred follow-up activities
visit to research facilities in Poland
follow-up meetings of participants
sharing of resources, best practices
establishment of networks
H. Howaniec

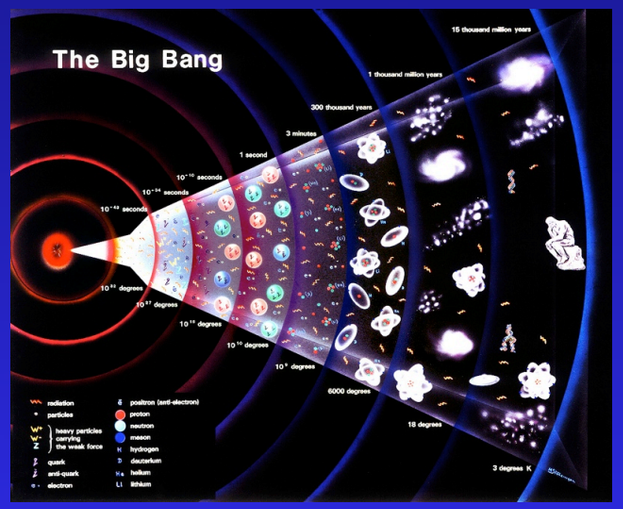
Teaching resources

All teacher courses and materials are recorded and archived

Special school materials, video clips, animations, games are produced

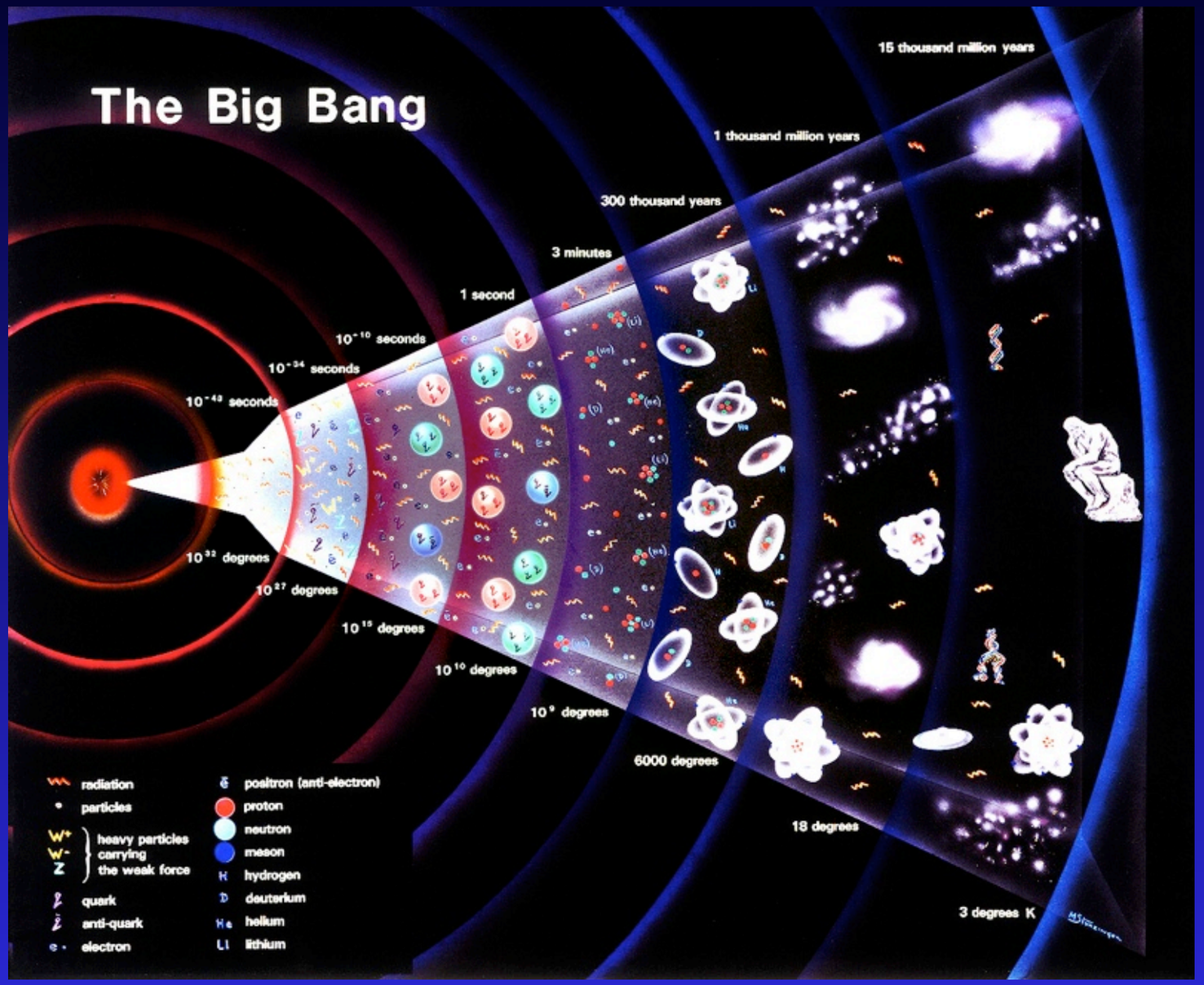
Video-Conferences between school classes and CERN scientists

CERN education website: education.web.cern.ch/education

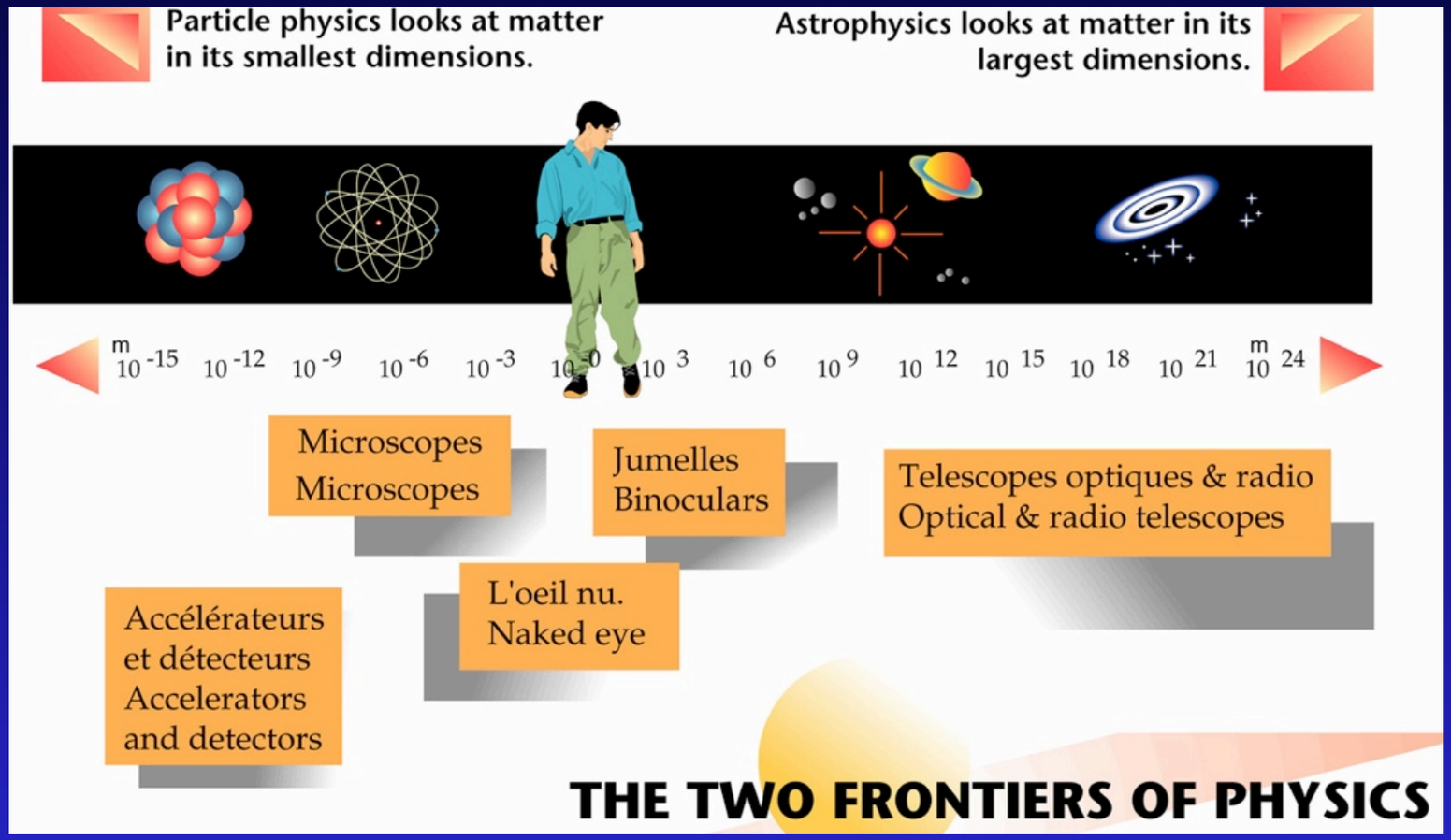


Graphics

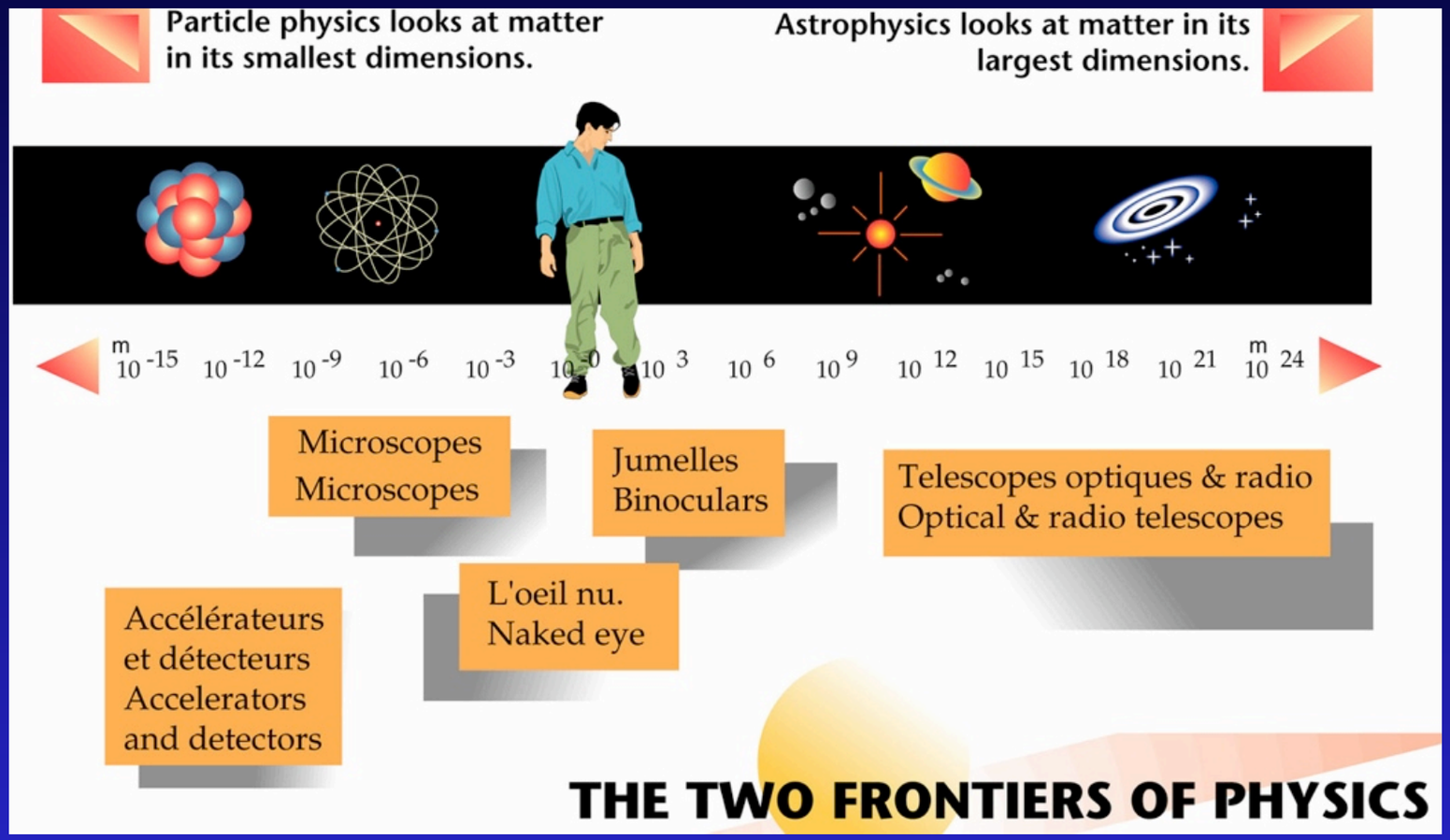
Graphics


The Big Bang
15 thousand million years
1 thousand million years
300 thousand years
3 minutes
1 second
10^{-10} seconds
10^{-34} seconds
10^{-43} seconds
10^{32} degrees
10^{27} degrees
10^{15} degrees
10^{10} degrees
10^{9} degrees
6000 degrees
18 degrees
3 degrees K
radiation
particles
heavy particles carrying the weak force
quark
anti-quark
electron
positron (anti-electron)
proton
neutron
meson
hydrogen
deuterium
helium
lithium

Graphics

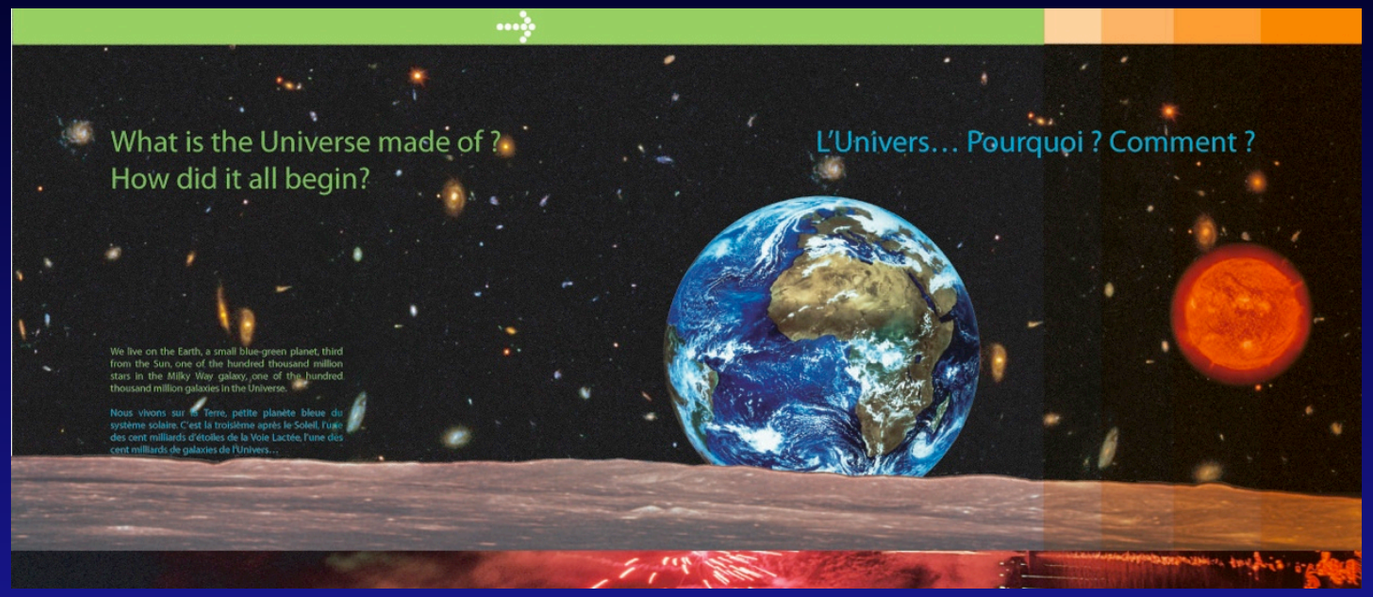

Particle physics looks at matter in its smallest dimensions.
Astrophysics looks at matter in its largest dimensions.
m
10 -15
10 -12
10 -9
10 -6
10 -3
10 0
10 3
10 6
10 9
10 12
10 15
10 18
10 21
m
10 24
Microscopes
Microscopes
Jumelles
Binoculars
Telescopes optiques & radio
Optical & radio telescopes
L'oeil nu.
Naked eye
Accélérateurs
et détecteurs
Accelerators
and detectors
THE TWO FRONTIERS OF PHYSICS

Graphics



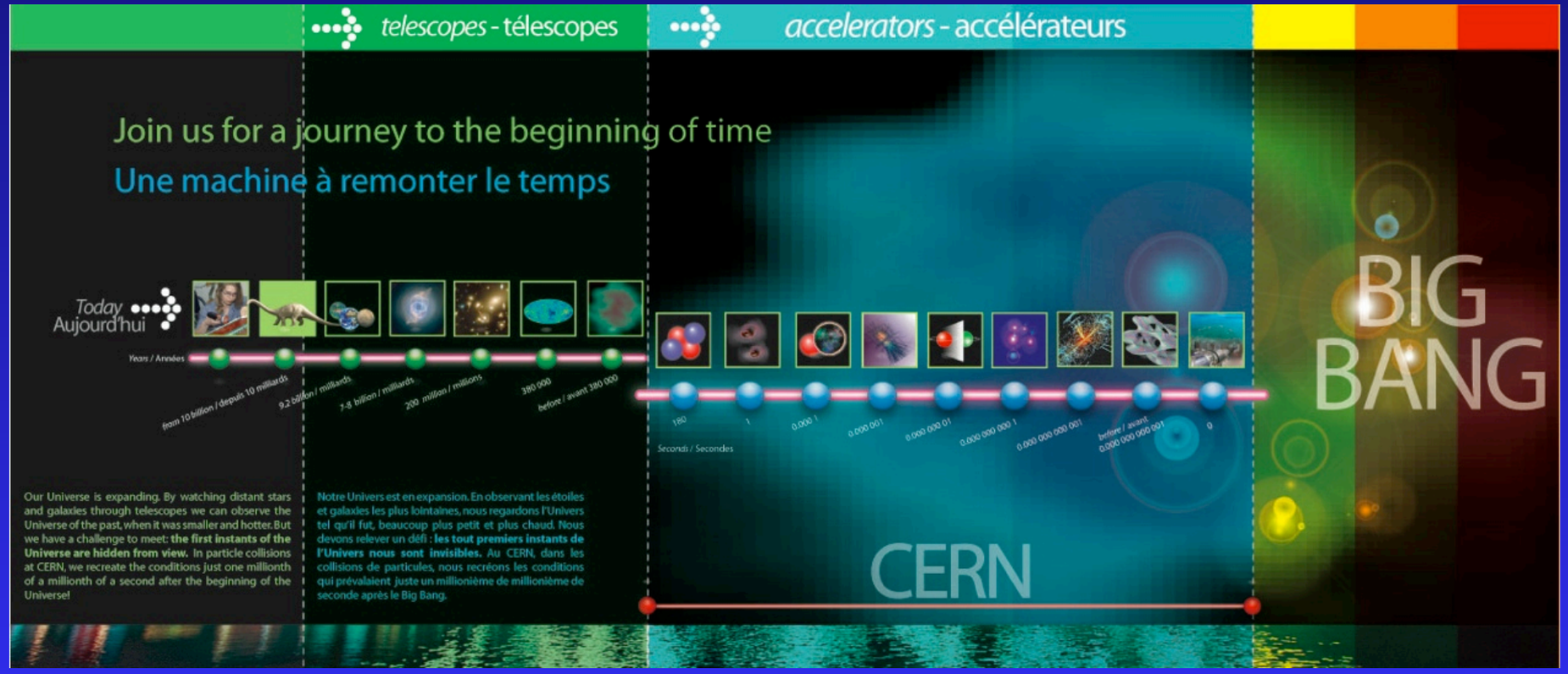
press.web.cern.ch/press/PhotoDatabase/welcome.html

Posters: Evolution of the Universe



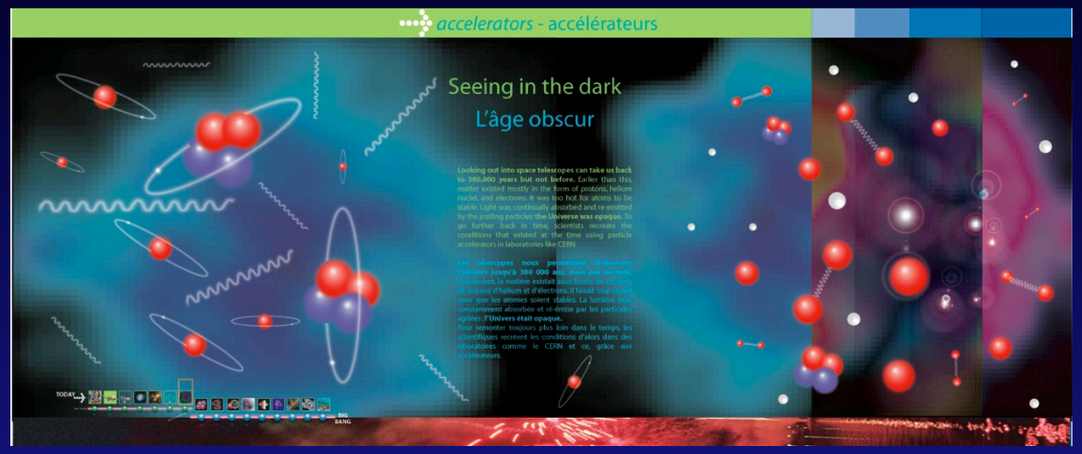
17 posters

Key concepts of
the evolution of matter

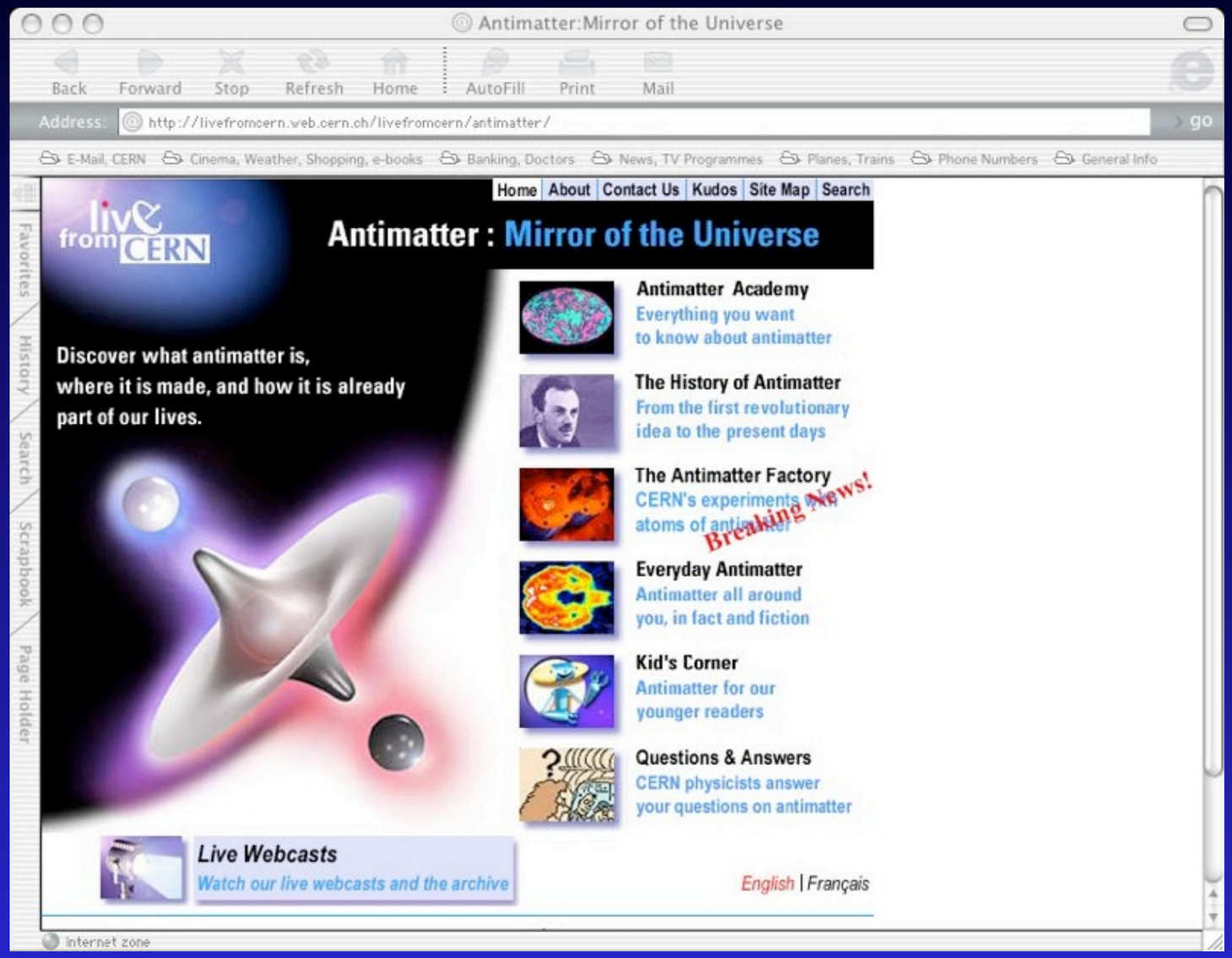


Evolution of the Universe (2)

Evolution of the Universe (3)



Topical websites (e.g. Antimatter)



livefromcern.web.cern.ch/livefromcern/antimatter/

Games

microcosm.web.cern.ch/microcosm/LHCGame/LHCGame.html

7) CERN - EIROForum* Education Programmes

Science On Stage

Science In School journal

*EIROForum = CERN + EFDA + EMBL + ESA + ESO + ESRF + ILL

Science On Stage

Increase attractiveness of science lessons!

Exchange of successful, innovative teaching methods

Multi-disciplinary SCIENCE TEACHING FAIR, workshops

29 countries organize **national** events (~ 2000 participants)

450 teachers meet at **international festival (awards)**

2005 CERN (Geneva)

2007 ESRF/ILL (Grenoble)

(Physics on Stage: 2000 CERN, 2002 ESA, 2003 ESA)

Science In School journal

Since March 2006 - now at Issue 8

4 issues/year, 88 pages; English (print)

30,000 copies; distributed in 38 countries

Science In School: Interest is growing very fast ...

More than 5000 registrations for e-mail alerts

Summary

CERN is very active in education

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Increase motivation of teachers (hence students)

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No emphasis on mathematical/deductive approach

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No emphasis on mathematical/deductive approach

Easy availability of suitable material on web

CERN is very active in education