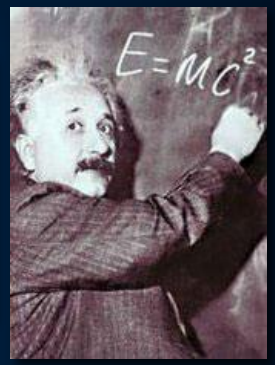
Welcome - Καλώς ήρθατε

His Excellency Mr. Apostolos Tzitzikostas

Governor
Region of Central Macedonia
Greece

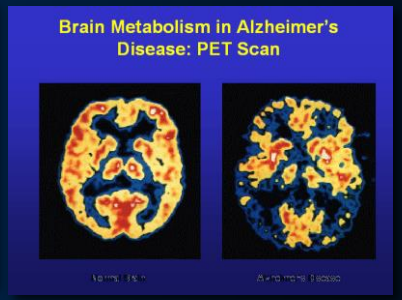
to CERN *Accelerating Science and Innovation*

The Mission of CERN



- **Push back** the frontiers of knowledge

  E.g. the secrets of the Big Bang …what was the matter like within the first moments of the Universe's existence?



- **Develop** new technologies for accelerators and detectors

  Information technology - the Web and the GRID

  Medicine - diagnosis and therapy

- **Train** scientists and engineers of tomorrow

- **Unite** people from different countries and cultures

CERN: founded in 1954: 12 European States
"Science for Peace"
Today: 22 Member States

~ 2300 staff +1530 other paid personnel
~ 12820 scientific users

Budget (2017) ~1000 MCHF

Member States: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Spain, Sweden, Switzerland and United Kingdom

Associate Member States: Cyprus, India, Pakistan, Serbia, Turkey, Ukraine

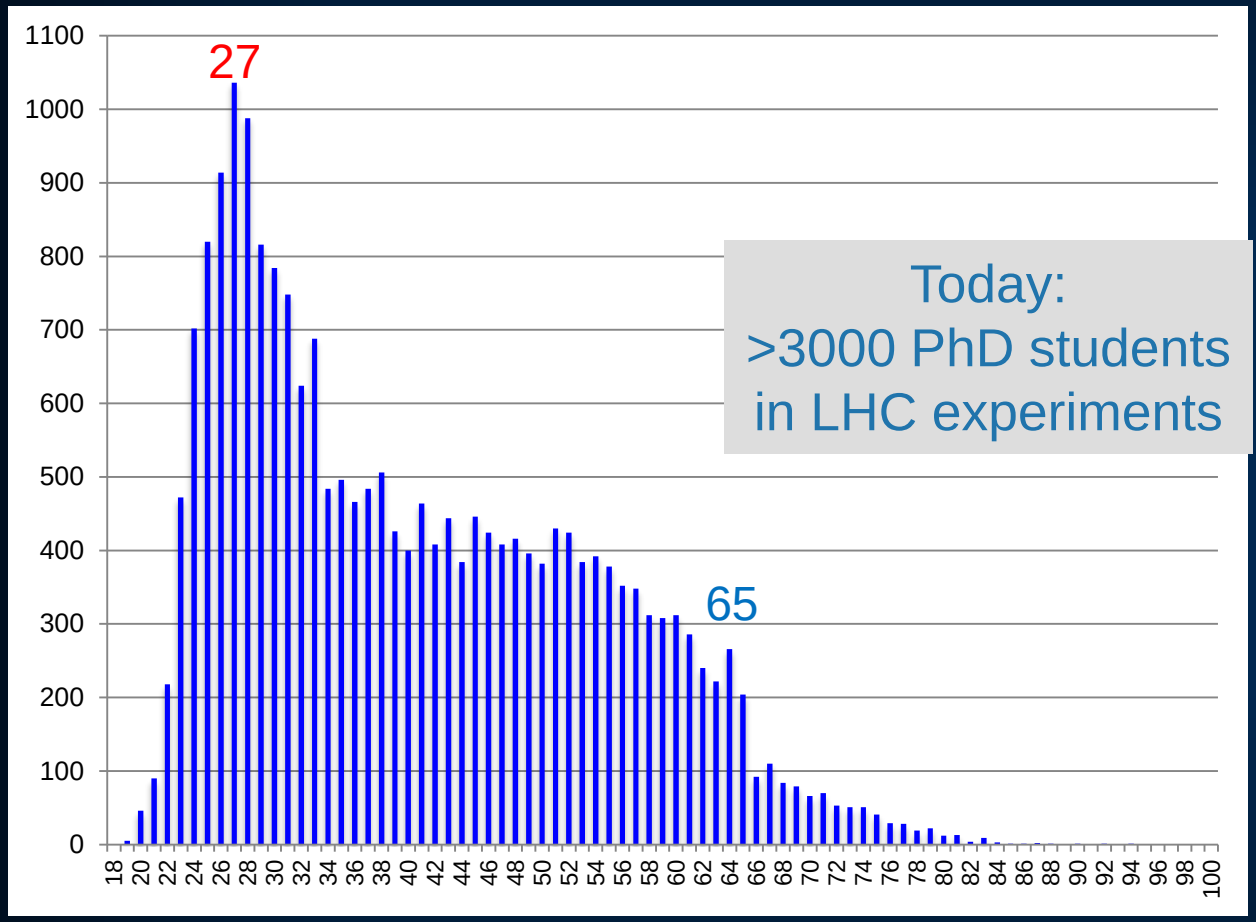
Applications for Membership or Associate Membership: Brazil, Croatia, Lithuania, Russia, Slovenia

Observers to Council (status being phased out): Japan, Russia, United States of America; European Union, JINR and UNESCO

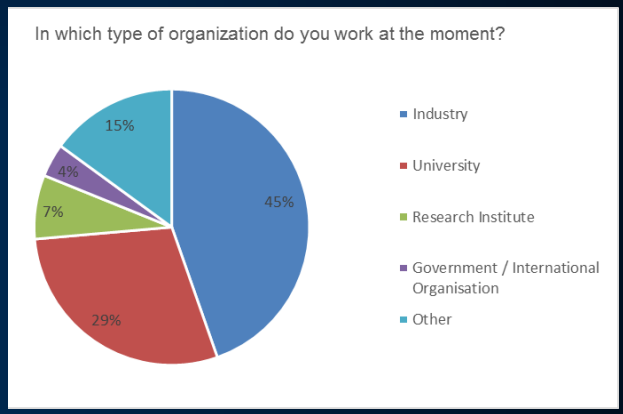
Science is getting more and more global

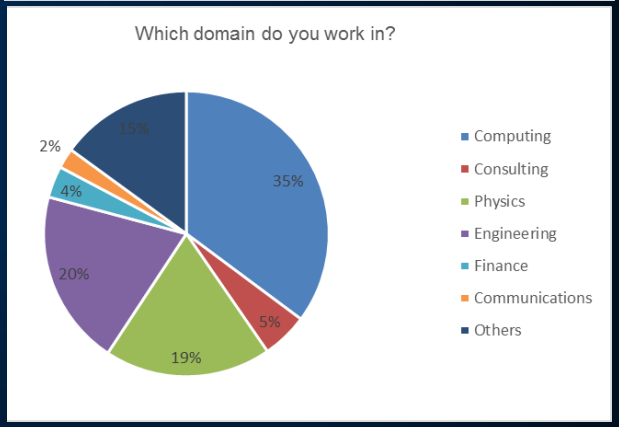
Age Distribution of Scientists

- and where they go afterwards



Today:
>3000 PhD students
in LHC experiments

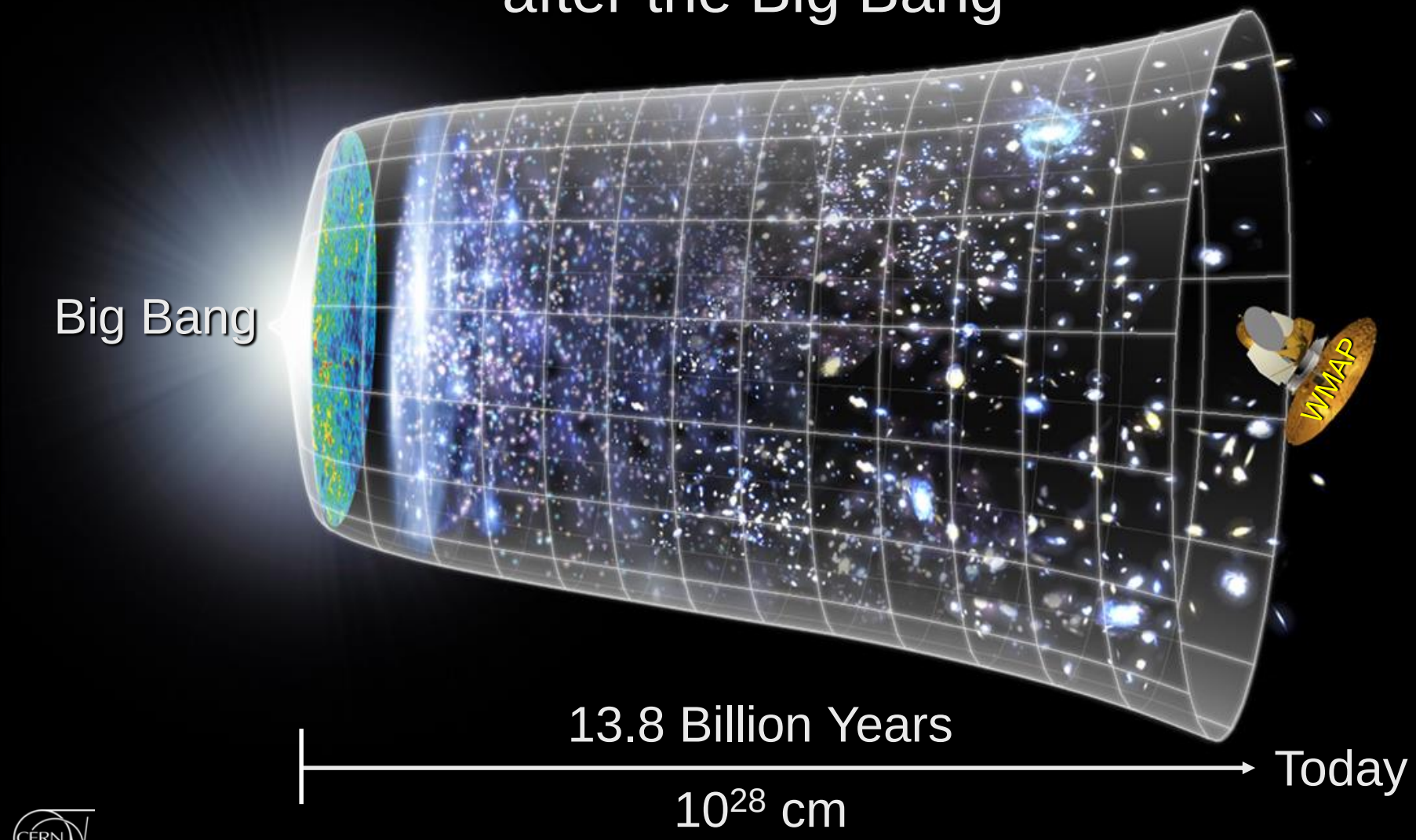


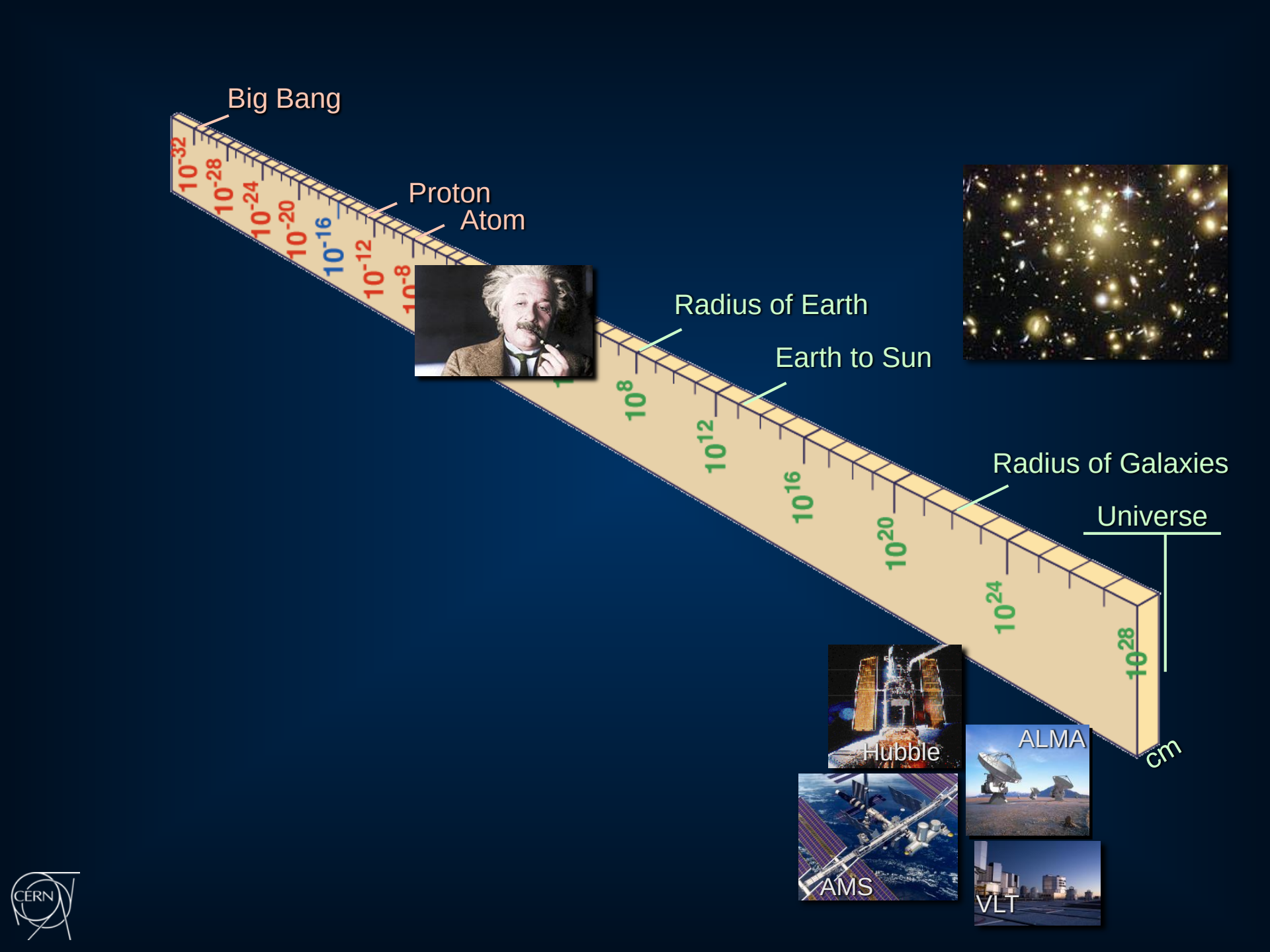


They do not all stay: where do they go?

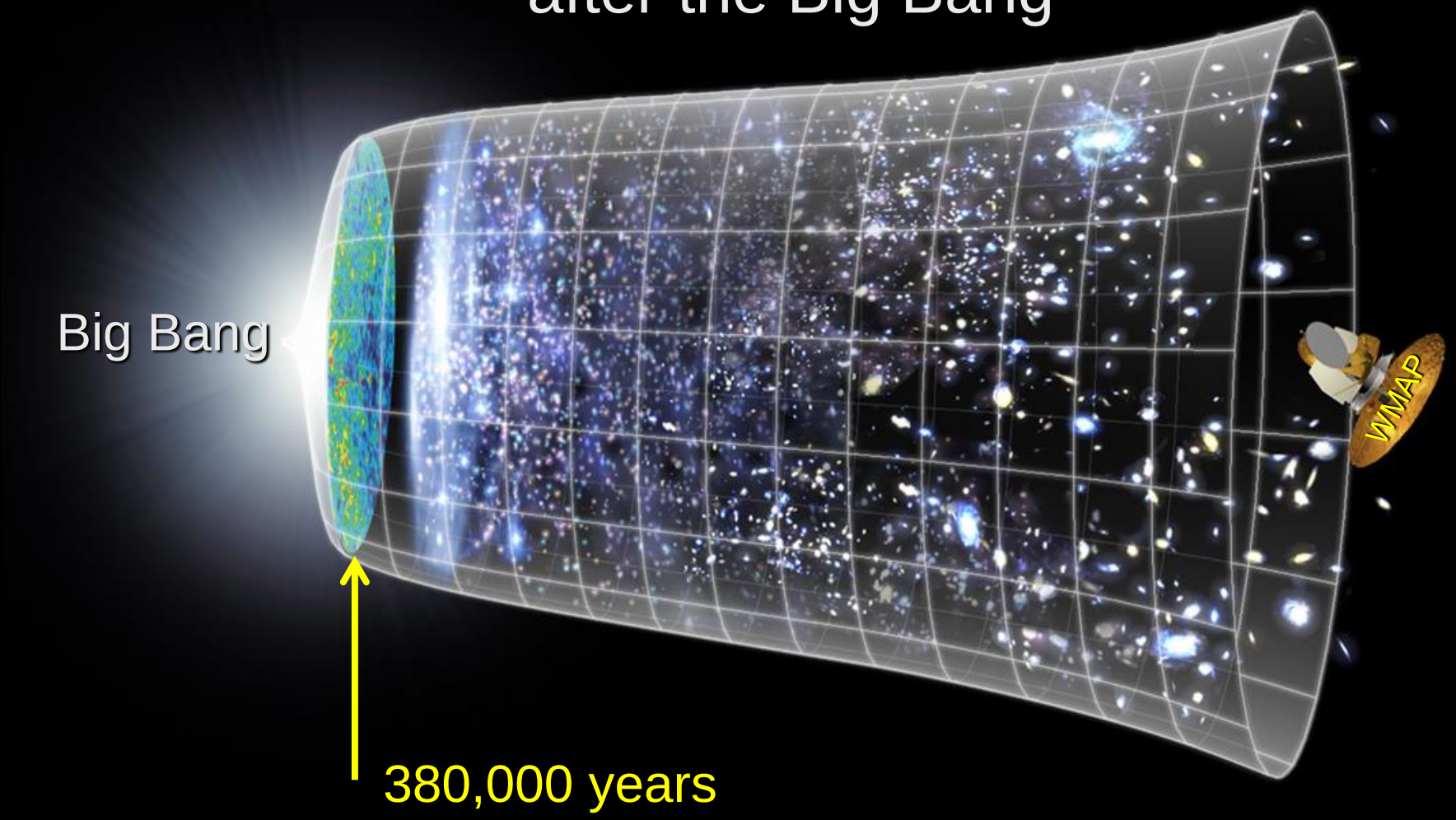
Next Scientific Challenge:

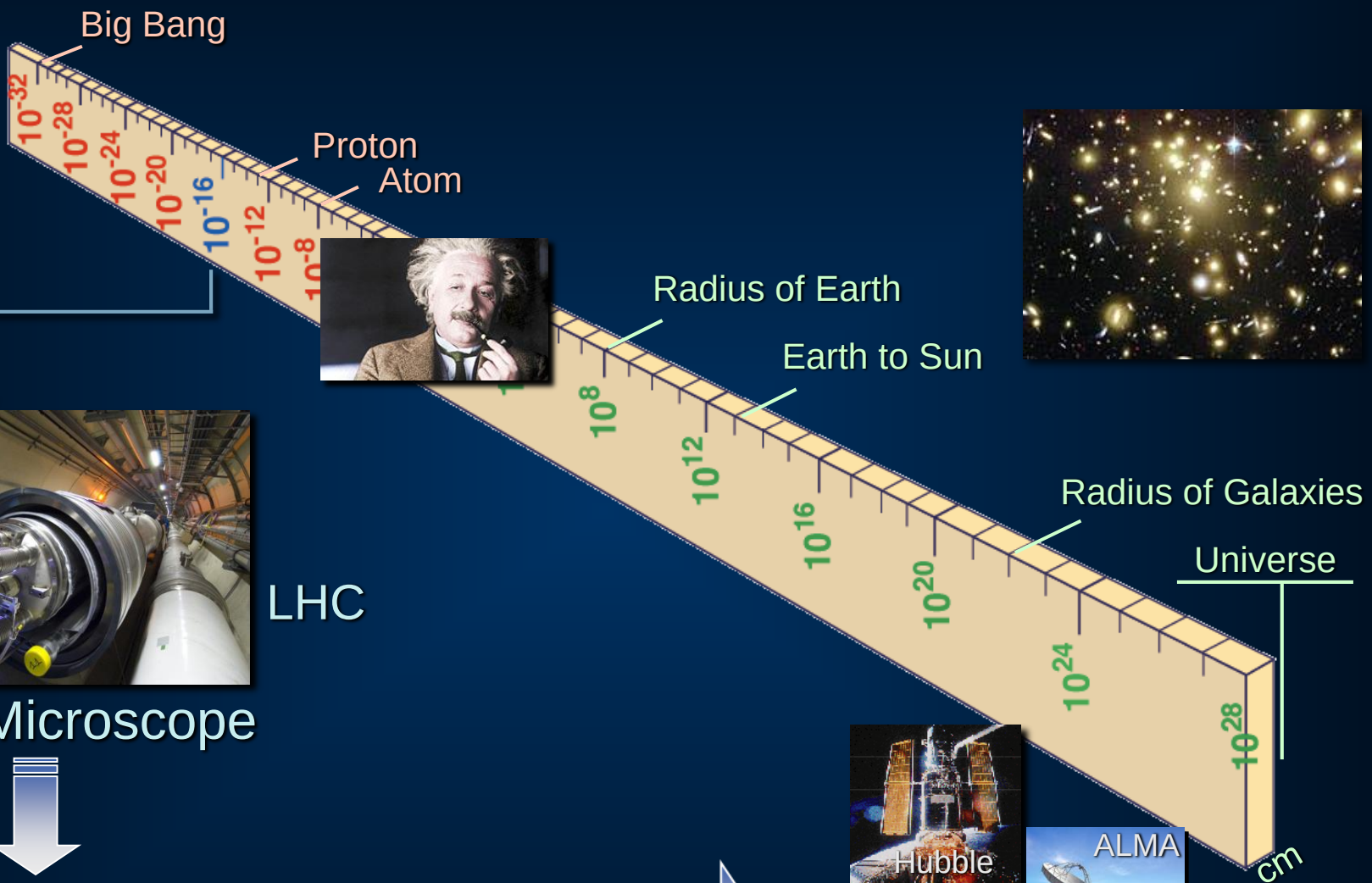
to understand the very first moments of our Universe after the Big Bang




Big Bang
Proton
Atom
Radius of Earth
Earth to Sun
Radius of Galaxies
Universe
10^{-32}
10^{-28}
10^{-24}
10^{-20}
10^{-16}
10^{-12}
10^{-8}
10^{8}
10^{12}
10^{16}
10^{20}
10^{24}
10^{28}
cm
Hubble
ALMA
AMS
VLT
CERN

Next Scientific Challenge:
to understand the very first moments of our Universe after the Big Bang



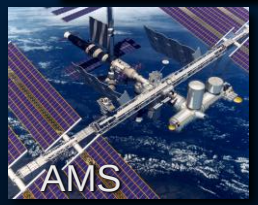


LHC

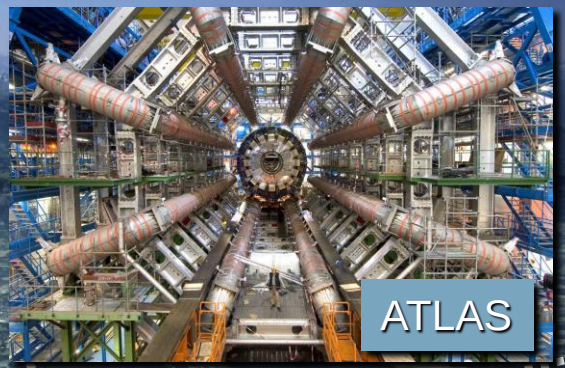
Super-Microscope

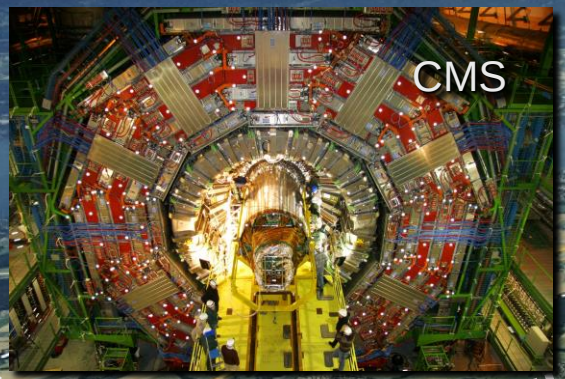
Reproducing conditions

Looking back



2010: a New Era in Fundamental Science





Exploration of a new energy frontier
in p-p and Pb-Pb collisions

CERN

Discovery 2012, Nobel Prize in Physics 2013

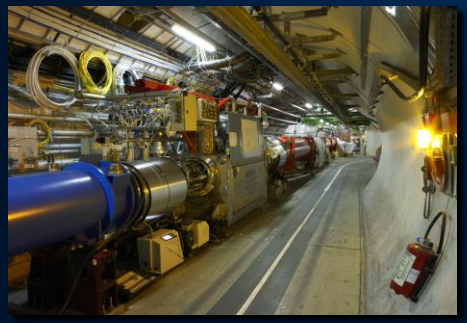
The Nobel Prize in Physics 2013 was awarded jointly to François Englert and Peter W. Higgs *"for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider".*

Innovation
Education
CERN
uniting people
Research

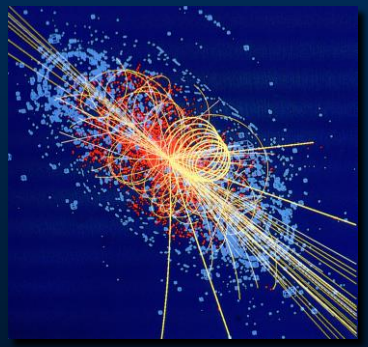
CERN: Particle Physics and Innovation

- Interfacing between fundamental science and key technological developments

- CERN Technologies and Innovation



Accelerating particle beams



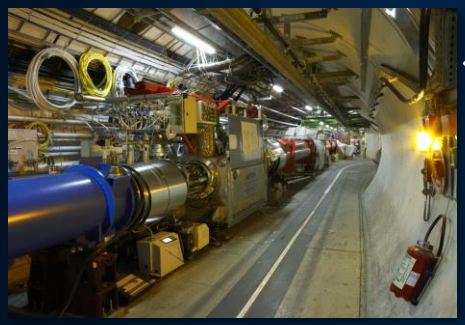
Detecting particles

Large-scale computing (Grid)

CERN

Medical Application as an Example of Particle Physics Spin-off

Combining Physics, ICT, Biology and Medicine to fight cancer

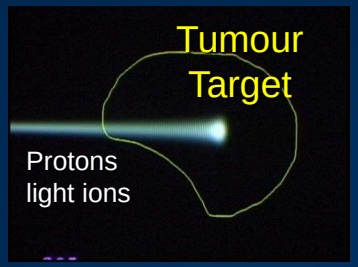


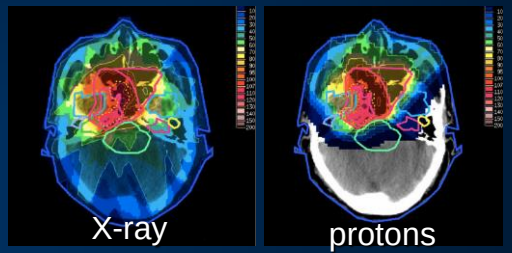
Accelerating particle beams

~30’000 accelerators worldwide

~17’000 used for medicine

Hadron Therapy

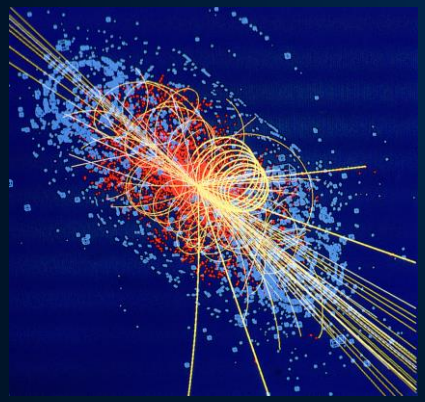




Leadership in Ion Beam Therapy now in Europe and Japan

>100’000 patients treated worldwide (45 facilities)

>50’000 patients treated in Europe (14 facilities)

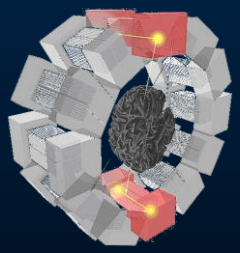


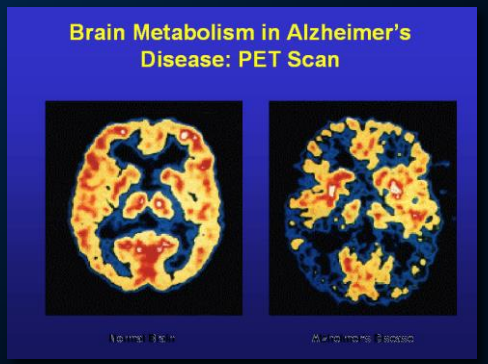
Detecting particles

Imaging

Clinical trial in Portugal, France and Italy for new breast imaging system (ClearPEM)

PET Scanner



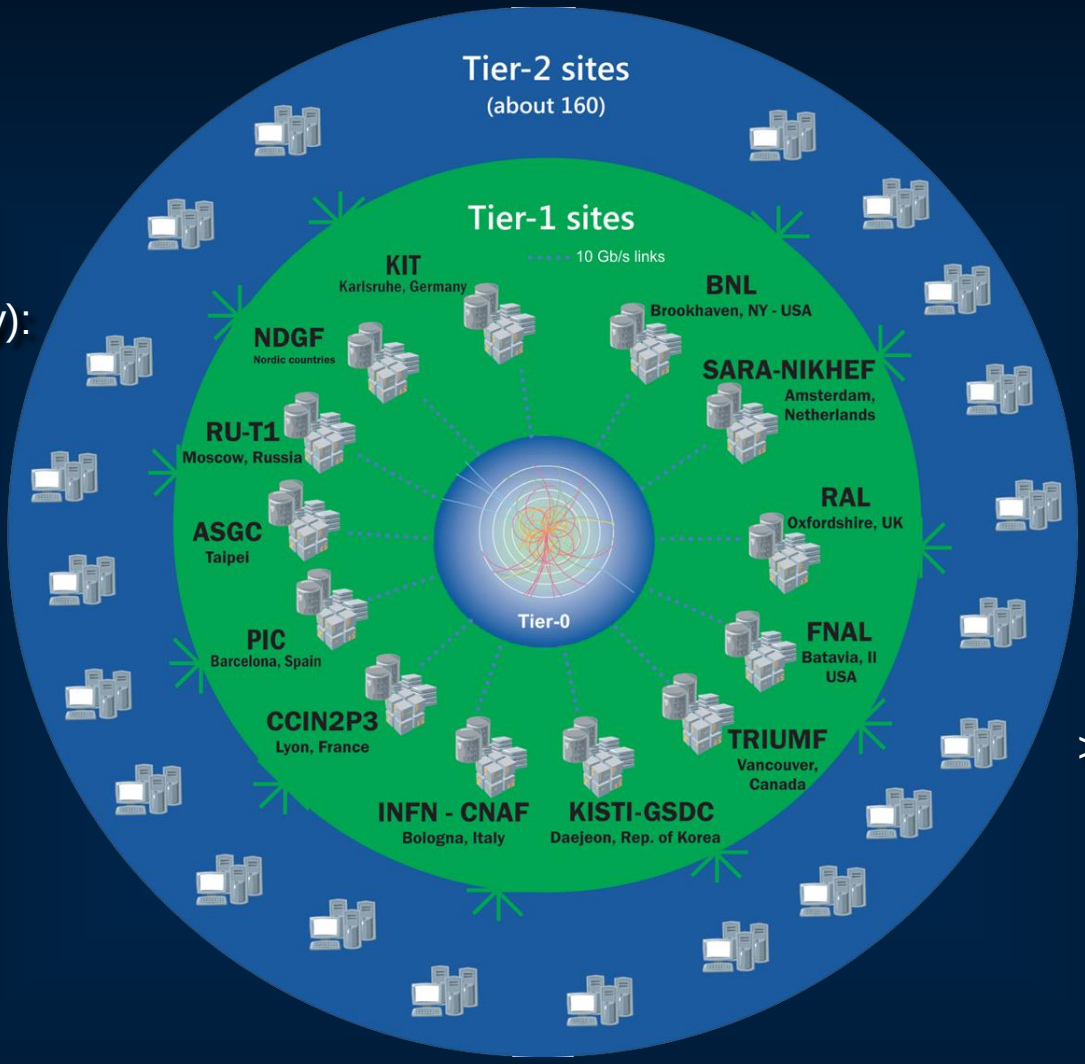


The Worldwide LHC Computing Grid

Tier-0
(CERN and Hungary):
data recording,
reconstruction and
distribution

Tier-1: permanent
storage, re-
processing,
analysis

Tier-2: Simulation,
end-user analysis



~170 sites,
40 countries

~500k CPU cores

500 PB of storage

> 2 million jobs/day

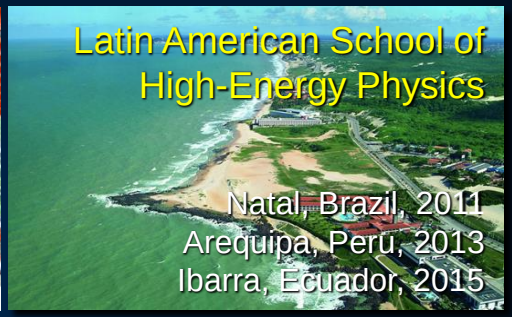
10-100 Gb links

WLCG:
An International collaboration to distribute and analyse LHC data

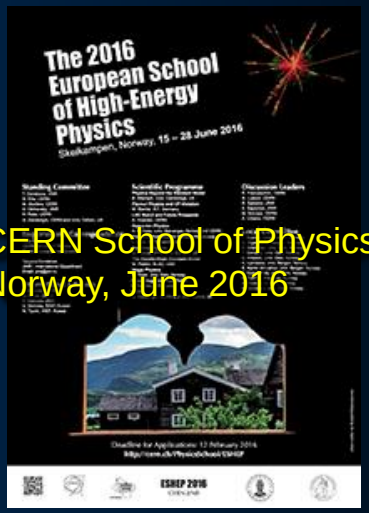
Integrates computer centres worldwide that provide computing and storage resource into a single infrastructure accessible by all LHC physicists

CERN Education Activities

Scientists at CERN
Academic Training Programme



Young Researchers
CERN School of High Energy Physics
CERN School of Computing
CERN Accelerator School

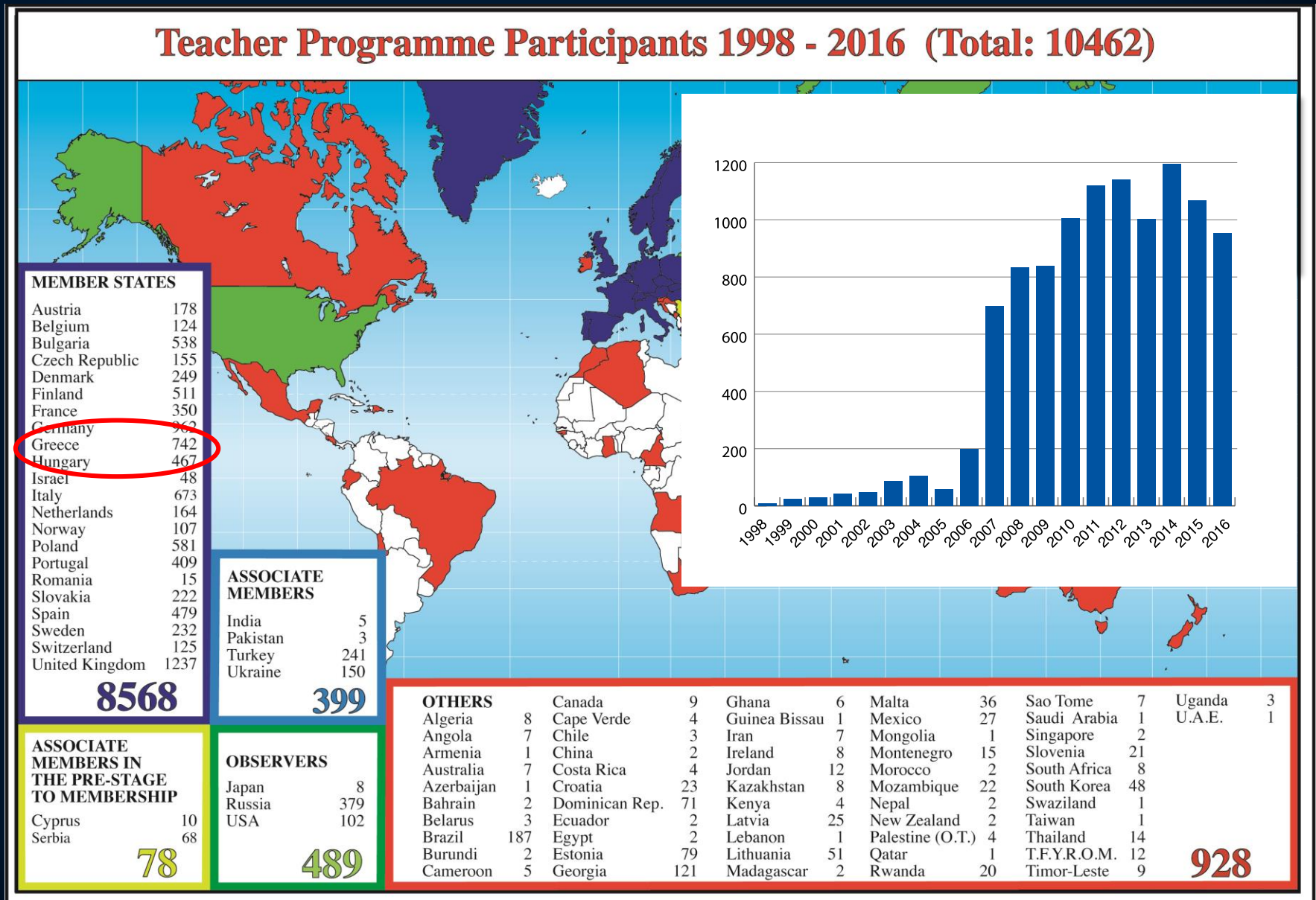


CERN School of Physics
Norway, June 2016

Physics Students
Summer Students Programme

CERN Teacher Schools
International and National Programmes

CERN Teacher Programme



Summer Students 2016

Summer Students 2016

MEMBER STATES	147
Austria	4
Belgium	3
Bulgaria	4
Czech Republic	3
Denmark	5
Finland	3
France	13
Germany	23
Greece	7
Hungary	2
Israel	3
Italy	16
Netherlands	10
Norway	2
Poland	5
Portugal	5
Romania	7
Slovakia	3
Spain	9
Sweden	7
Switzerland	3
United Kingdom	12

OBSERVERS	49
India	16
Japan	5
Russia	9
USA	19

ASSOCIATE MEMBERS	7
Pakistan	4
Turkey	3

STATES IN ACCESSION FOR MEMBERSHIP	7
Cyprus	2
Serbia	5

OTHERS											
Albania	1	Colombia	1	Iran	2	Madagascar	1	Singapore	1	Venezuela	1
Algeria	3	Costa Rica	3	Ireland	1	Malaysia	3	Slovenia	1	Viet Nam	1
Azerbaijan	2	Croatia	2	Jamaica	1	Malta	4	South Africa	2		
Bangladesh	1	Cuba	1	Jordan	2	Mexico	1	Sri Lanka	1		
Belarus	1	Ecuador	1	Kazakhstan	1	Montenegro	2	Sudan	1		
Bosnia	2	Egypt	4	Korea	1	Nepal	1	Thailand	3		
Brazil	1	Georgia	1	Kyrgyzstan	1	Nigeria	2	T.F.Y.R.O.M.	3		
Canada	5	Ghana	1	Latvia	1	Oman	1	U.A.E.	1		
China	11	Guatemala	1	Lebanon	2	Palestine	2	Ukraine	3		
		Indonesia	3	Lithuania	1	Qatar	1	Uzbekistan	1		

95

Greece and CERN

- Greece was one of the 12 founding Member States of CERN (1954)
  - Greek researchers (from Greece and abroad) have made notable contributions to experimental & theoretical particle physics.
- Today, 9 universities and institutes in Greece are involved in particle physics at CERN : ATLAS, CMS, ALICE, several small experiments.
- Accelerator R&D: LHC, CLIC


LHCb
ATLAS
CERN Meyrin
CERN Prévessin
SPS 7 km
SUISSE
FRANCE
CMS
ALICE
LHC 27 km
Thank You!
CERN
Accelerating Science and Innovation