



the
abdus salam
international centre for theoretical physics

ICTP 40th Anniversary

H4.SMR/1574-28

"VII School on Non-Accelerator Astroparticle Physics"

26 July - 6 August 2004

Science and Society

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SCIENCE and SOCIETY

What can be done to make science easier to understand

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7th School, ICTP, Trieste 2004

1. Science and Technology
2. Science Outreach
3. Outreach in Internet
4. Conclusions

1. Science and technology

- Science is interested in the laws of nature
- Technology applies scientific knowledge to make new machinery and tries to "dominate" nature

Without scientific research there is no technological progress

Without technology we would not have new instruments for research

- Fundamental research is a powerful cultural force. Like the arts, science is creative and enriching
- Most of the great technological revolutions spun off from fundamental research
- How many people know that WWW (World Wide Web), the key which opens every gate of Internet, the prefix most used by web navigators, was invented for speeding communication in fundamental research in a large European Laboratory for fundamental physics, CERN in Geneva?

Science and technology. Justifications

- -Technological development → economic progress, increased well-being → environmental risks →

- Why do we perform research in particle physics?

Standard answers: i) To understand the structure of matter and of what holds it together; ii) to improve our teaching; iii) for technical spin-offs and also to satisfy our curiosity, and therefore we enjoy doing it

- Can we justify the enormous costs?

We need to explain what we do and how we spend the taxpayer money, besides assuring that we are not spoiling the environment

2. Science outreach

"If you are not able to explain to your aunt in less than 5 minutes what you are doing in physics, then you have not really understood what you do"

(G. Puppi)

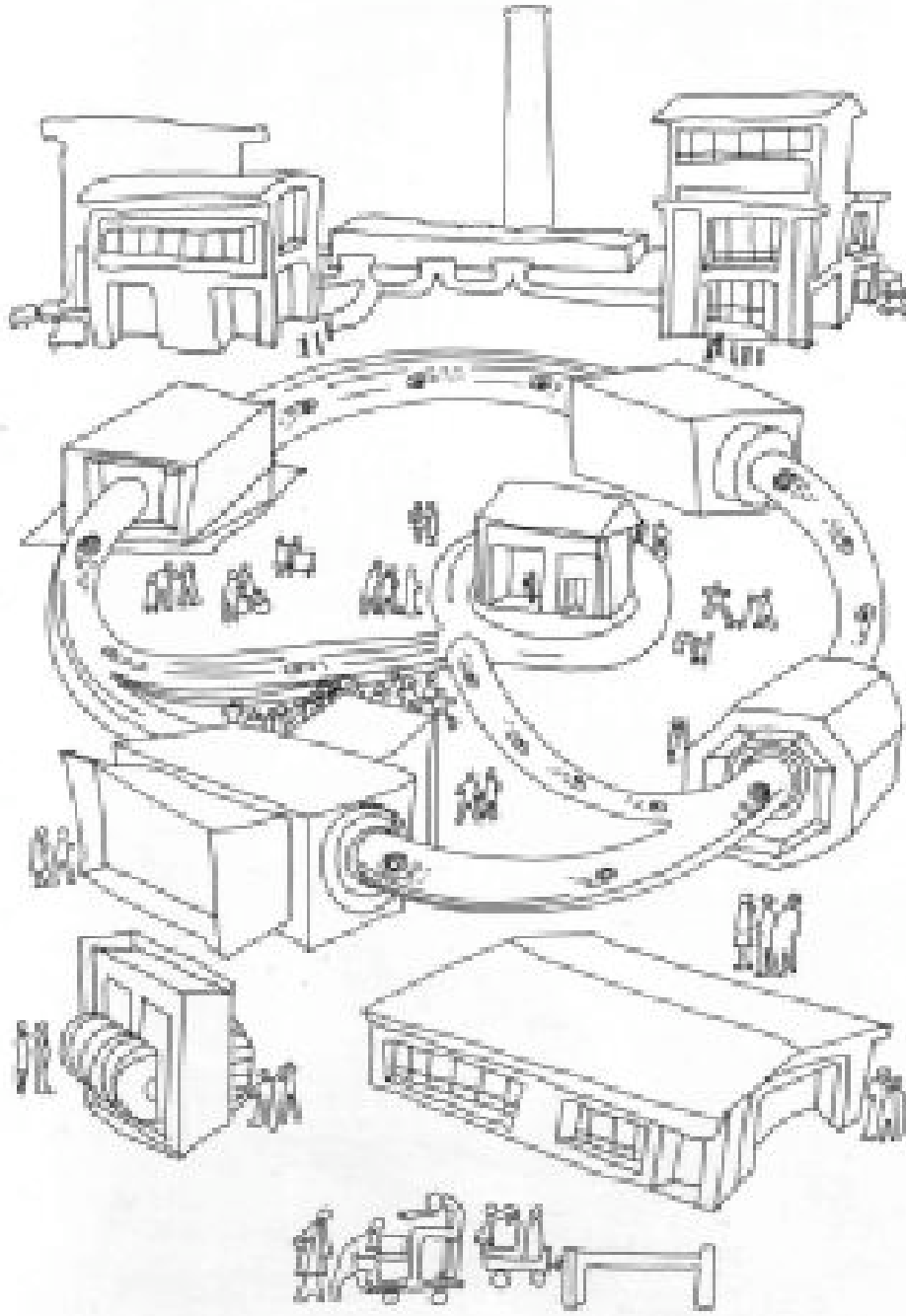
My aunt after my explanation of particle physics
(P. Waloscheck)

gg - Scienza e Societa'



Scientific knowledge update

- Continuous updating of the scientific knowledge is needed to understand the great scientific and technological changes
- This must be done properly, stimulating the interest; it is not easy, and the mass media often do not help
- For instance the media insist on the hydrogen economy, forgetting that there are no hydrogen "mines";
vaccinations saved millions of people, but only the few unhappily lost ones become news
- Great emphasis is reserved to magic, horoscopes, divinations and little is done for proper scientific information



The Big Science

Laboratories and Institutes join to create a large central lab, which later attracts an increasing number of users .

The big centres may evolve and also have industrial character, which requires professional public relation activity

(P. Waloschek)

3. Outreach in schools. Internet

Most of the high school physics teachers followed university courses several years ago, when the teaching did not involve many of the present basic concepts of subnuclear physics, like the quark model. Regular refresher courses are advisable

One notices in the young generations a decreasing interest in sciences (physics, chemistry, ...); there has been a consistent decrease of university applications into scientific fields.

The Universities are worried and teachers are increasing their efforts for scientific outreach

Many web sites have been dedicated to scientific outreach. This was done first by large labs[CERN,]and now also by universities

Efforts are made to create sites simple and stimulating, using interesting approaches; figures are often animated/interactive

Interactive dictionaries for "difficult" technical names are useful

Antimatter

Antimatter: what is it? Something exotic and not real?

Everything you wanted to know about antimatter

Short history of antimatter

From the first revolutionary ideas to the present situation

Antimatter around us

From antimatter in cosmic rays to antimatter usage in PET

Antimatter at the beginning of the Universe

How much antimatter was there? How did it disappear?

Antimatter today in the Universe

Recent searches for antimatter

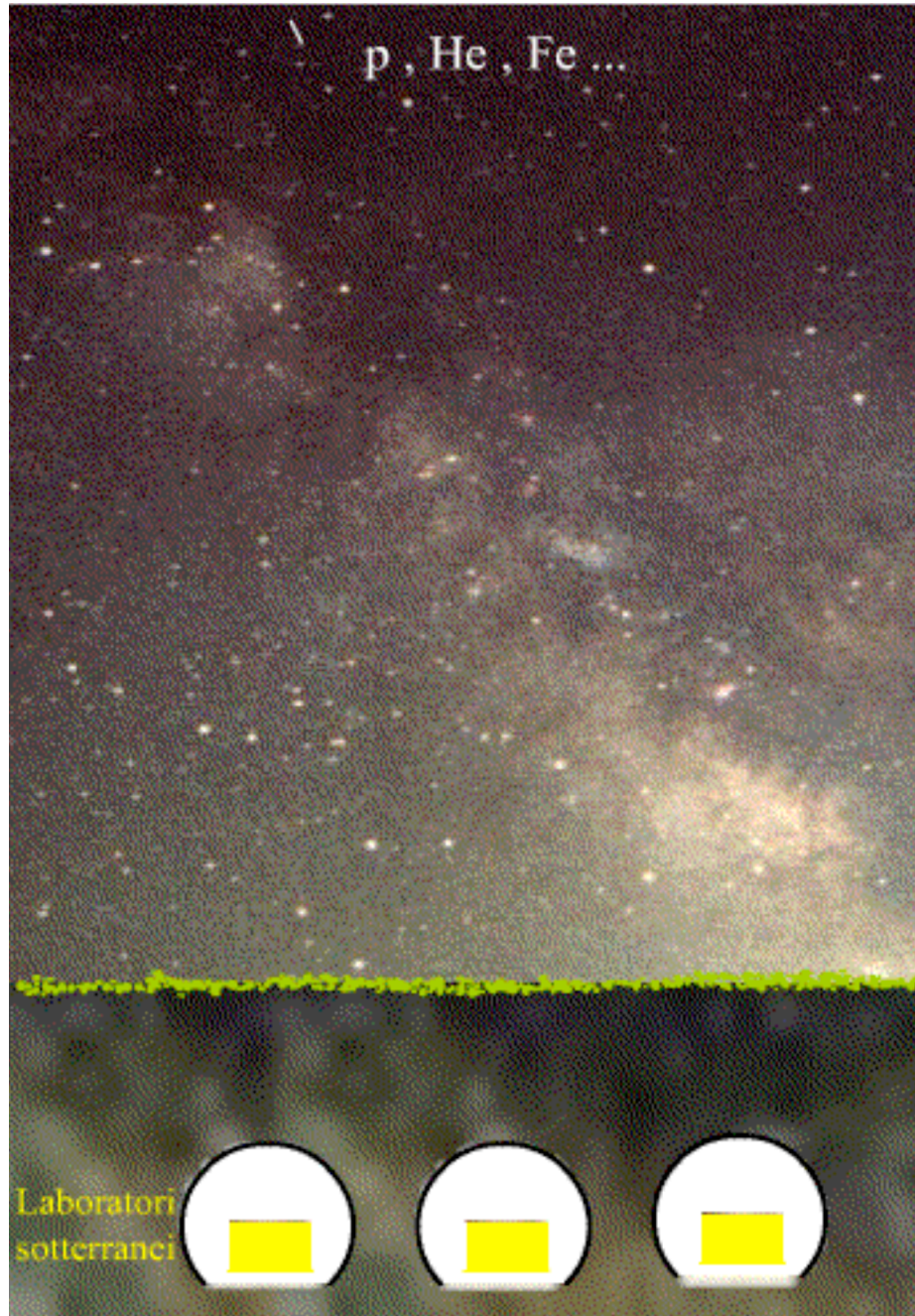
Antimatter at the University of Bologna

How does one study it?

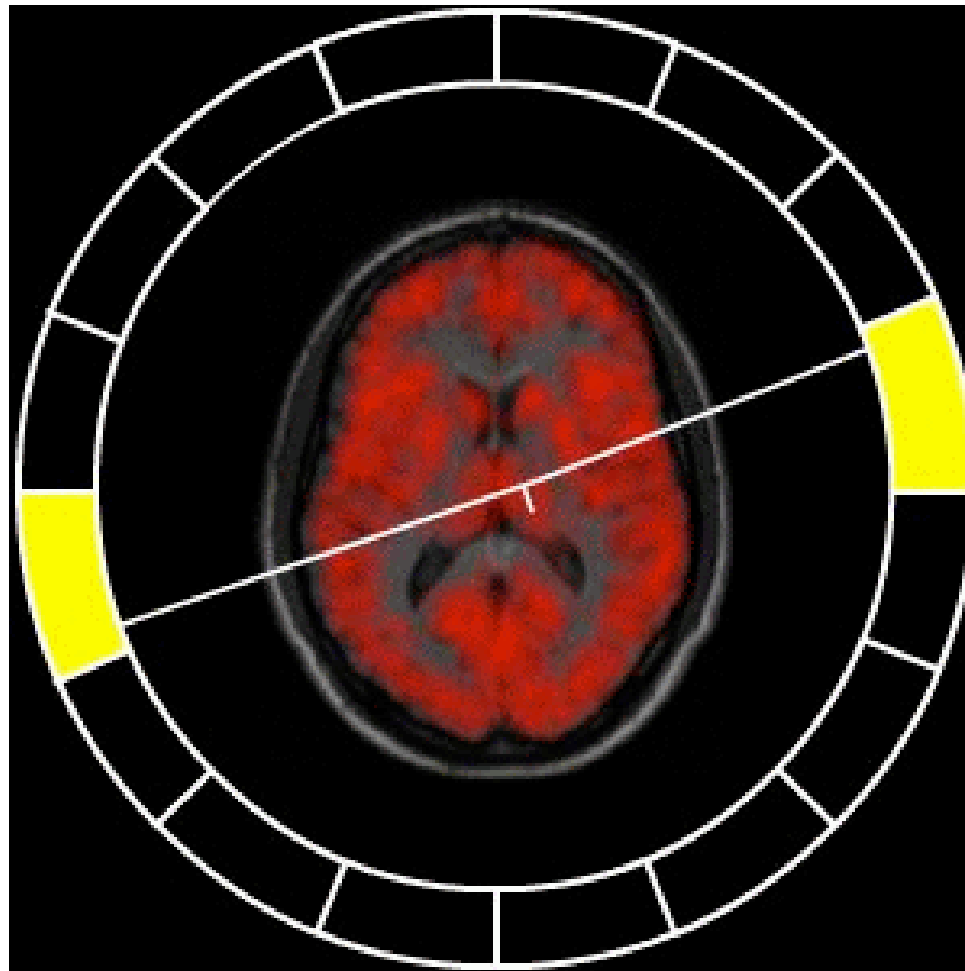
Questions & answers

Two CERN physicists answer some questions about antimatter

Glossary



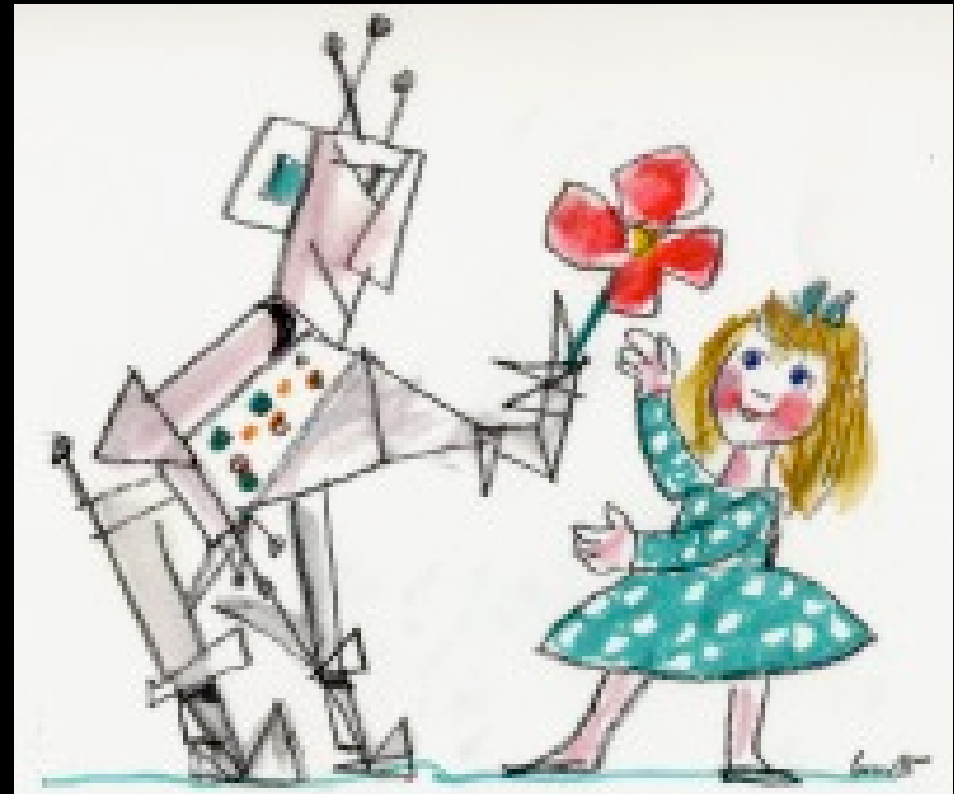
PET, positron emission tomography



Colliding galaxies



Artificial intelligence



Molecular machines

The need for miniaturization

Why smaller and smaller?

Supramolecular Chemistry and Nanotechnology

The chemist as a molecular engineer

Molecular electronics and photonics

Molecules that mimick the functions of the components of macroscopic devices

Molecular machines

What are they and how they operate

Natural molecular machines

The "invisibles" that sustain life

Artificial molecular machines

Can men make and operate nanomachines?

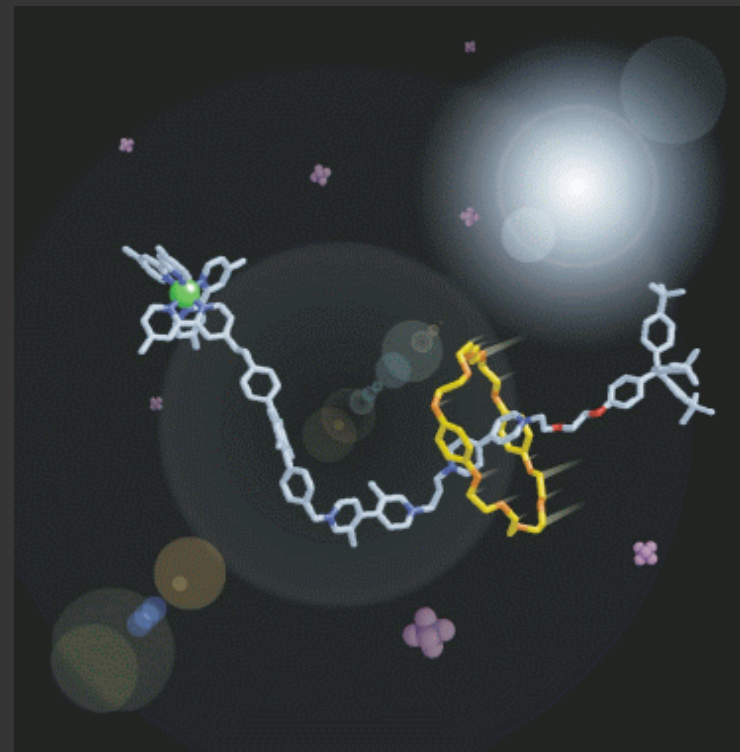
Logic operations with molecules

Towards a chemical computer?

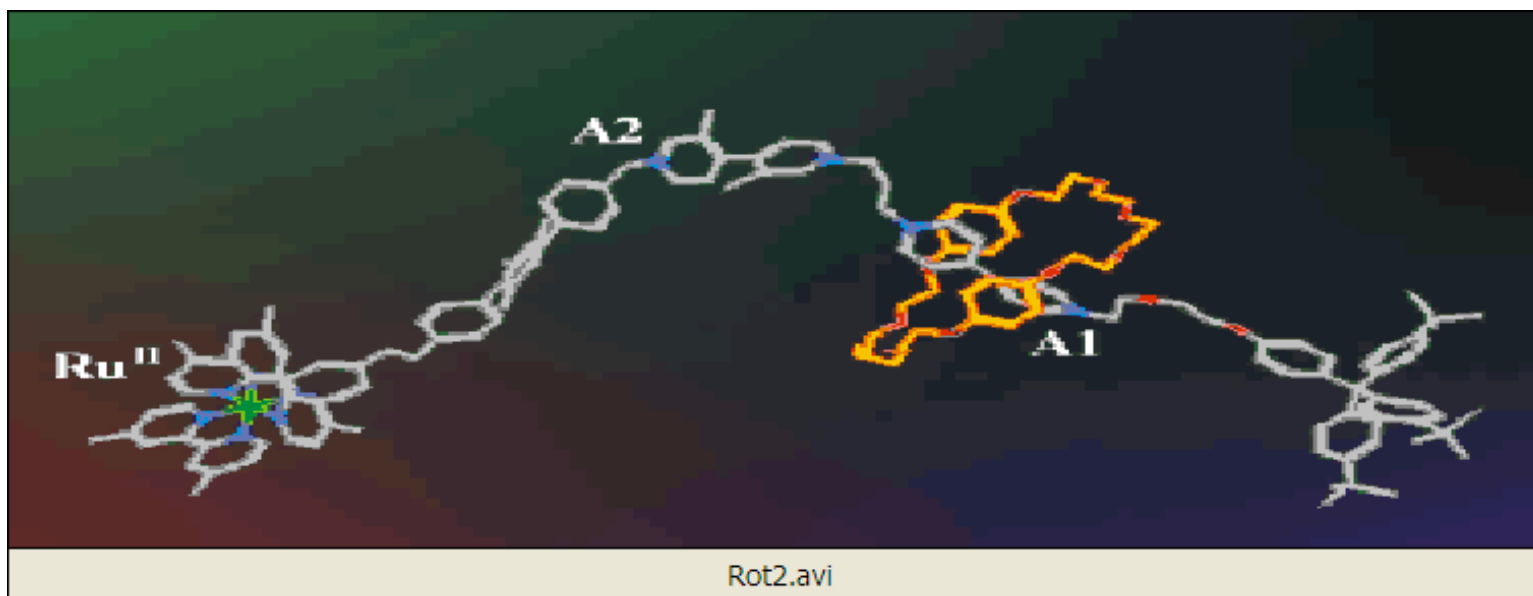
Where are molecular devices and machines studied?

Questions & Answers

Glossary



Navetta molecolare azionata da energia luminosa



Hydrogen 10%

Oxygen 65%

Carbon 18%

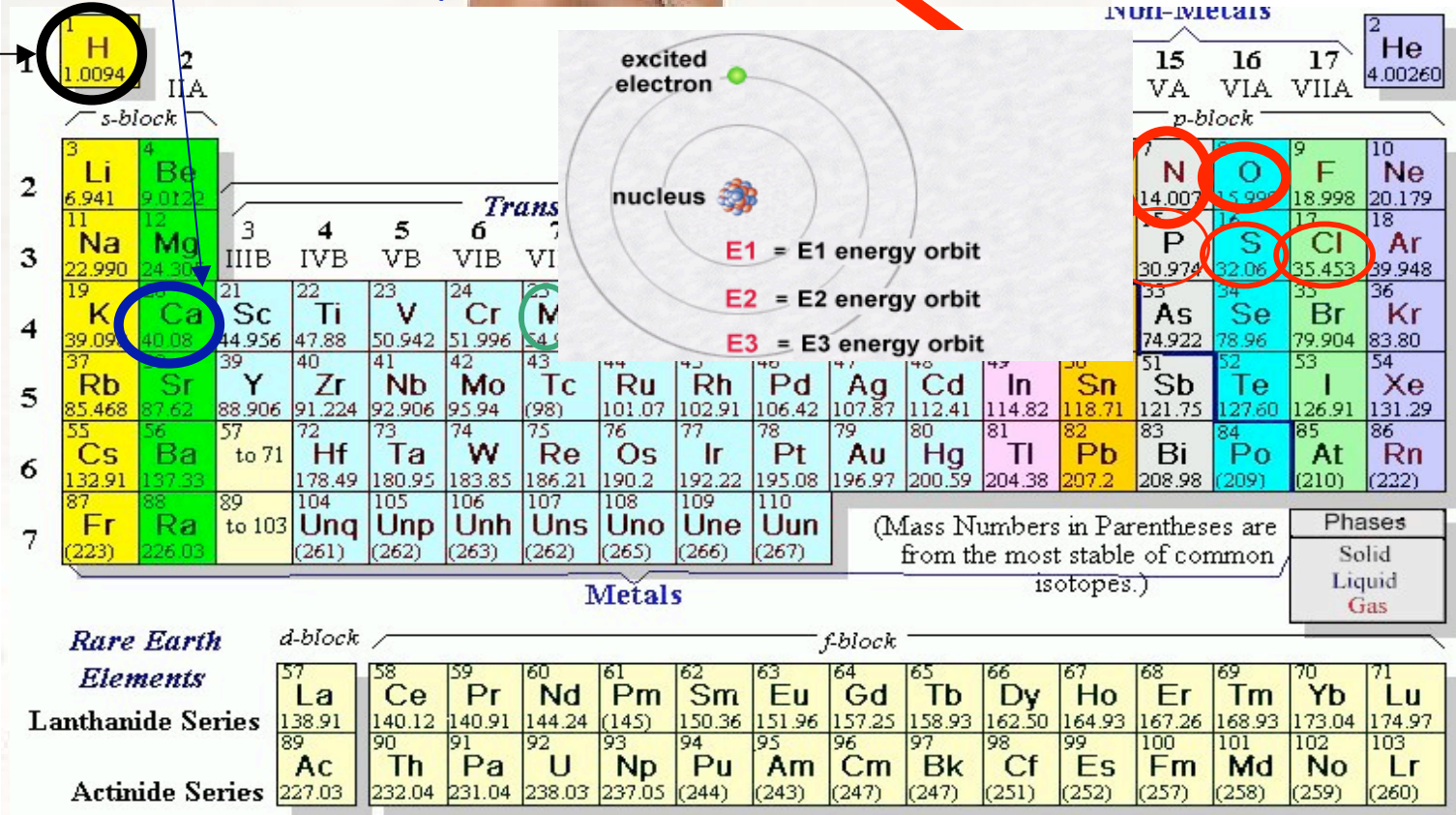
Nitrogen 3%

Phosphorus 1%

Calcium 1,5%



Chemical composition of the girl

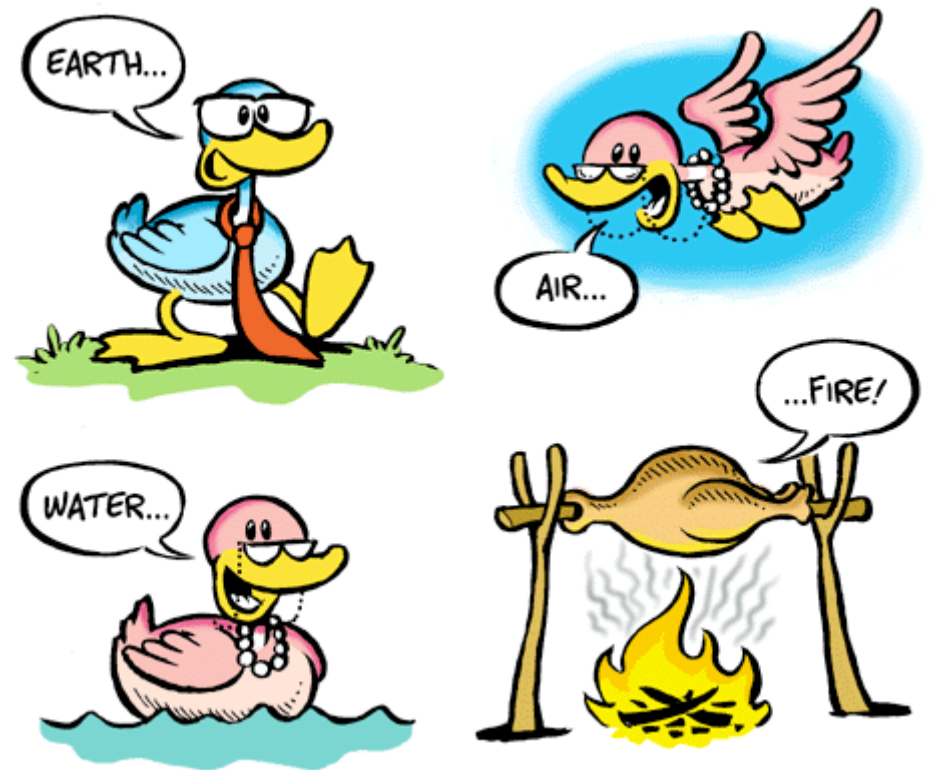


Potassio, Zolfo, Cloro, Magnesio, Zinco, Ferro

Tracce di:
iodio, rame, stagno, bromo, silicio, alluminio, manganese, cobalto nichel...

A First Theory

Since time immemorial people have been trying to understand what the Universe is made of. One of the earliest theories said that everything could be built from just four elements, Earth, Air, Fire and Water. This was a great scientific theory because it was simple. But it had one big drawback: it was wrong.



What is the World Made of?

Particle Data Group

Why do so many things in this world share the same characteristics?

People have come to realize that the matter of the world is made from a few fundamental building blocks of nature.

The word **"fundamental"** is key here. By fundamental building blocks we mean objects that are simple and structureless -- not made of anything smaller.



(c) Andy Brice 1998

Even in ancient times, people sought to organize the world around them into fundamental elements, such as earth, air, fire, and water.

The Radio Window on the Cosmos

All the colours of the Sky

Emission mechanisms

The Solar system

The Astonishing Jupiter

Where stars are born

Galactical Laboratories

How stars die

Supernovae

The centre of our galaxy

A Black Hole

Extragalactical Radio Sources

The Monsters of the Sky

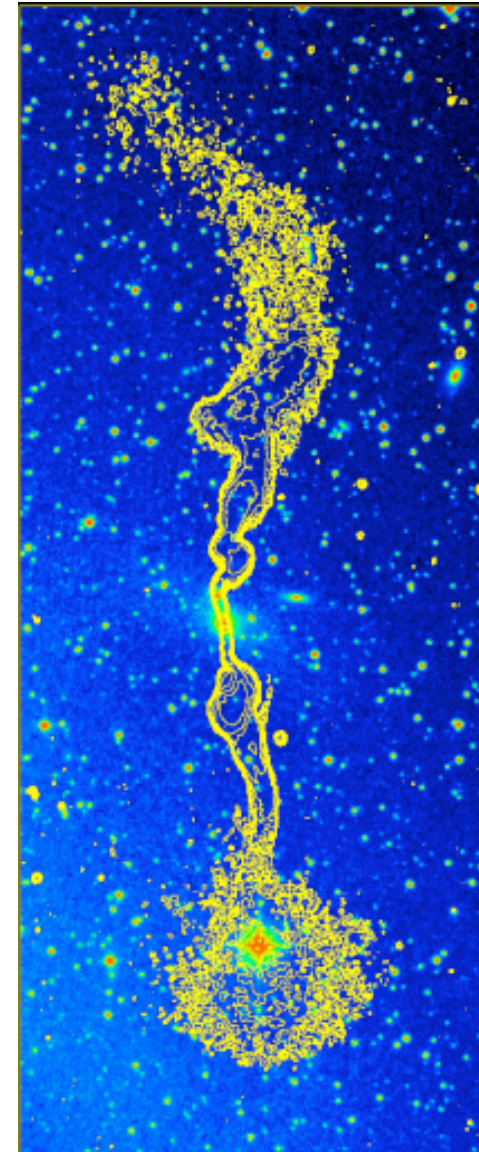
The Radio sky

Discovering the radio sky

Radioastronomical Instruments

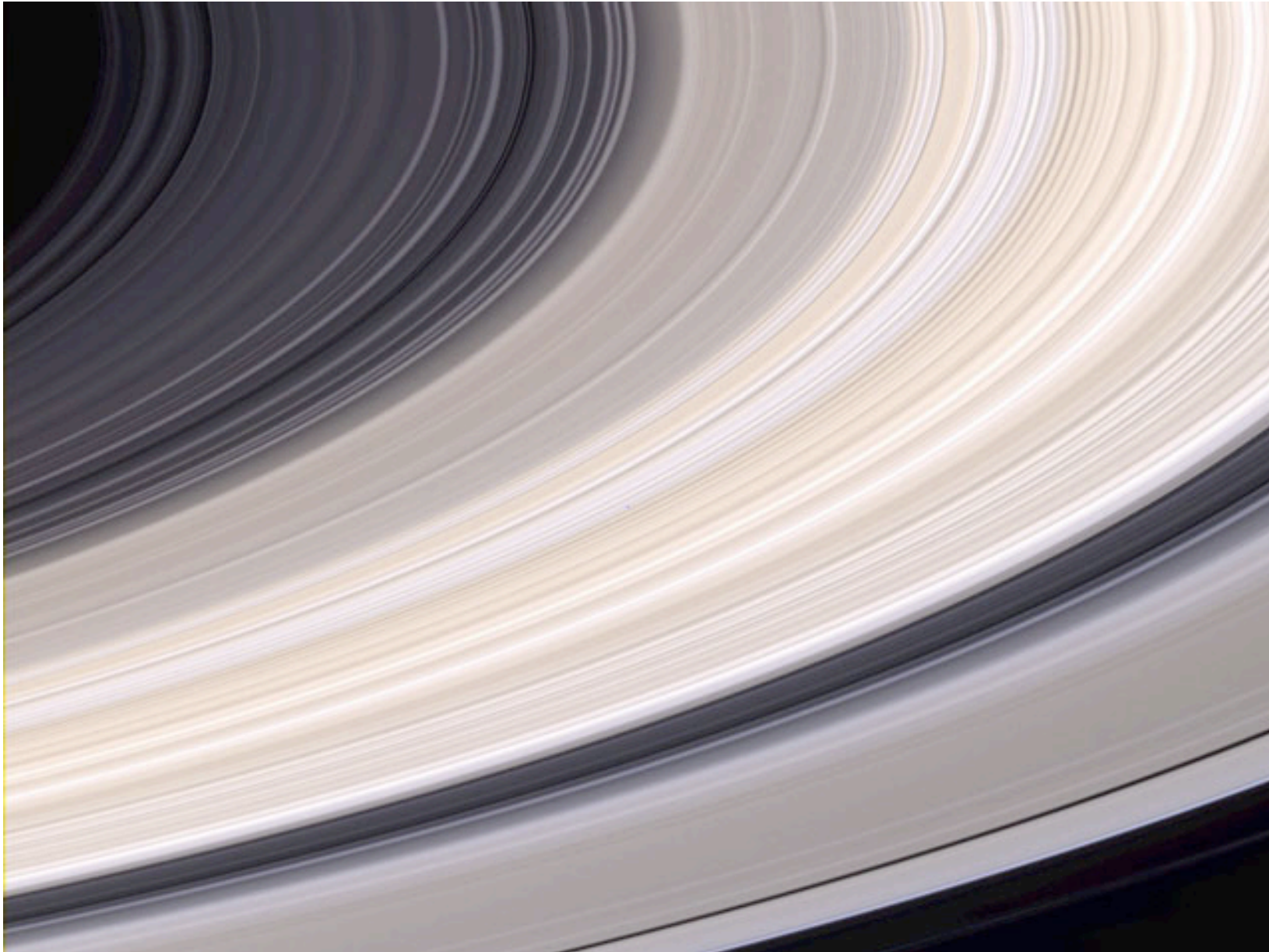
Looking at the radio sky with eyes as
large as the Earth

Dictionary

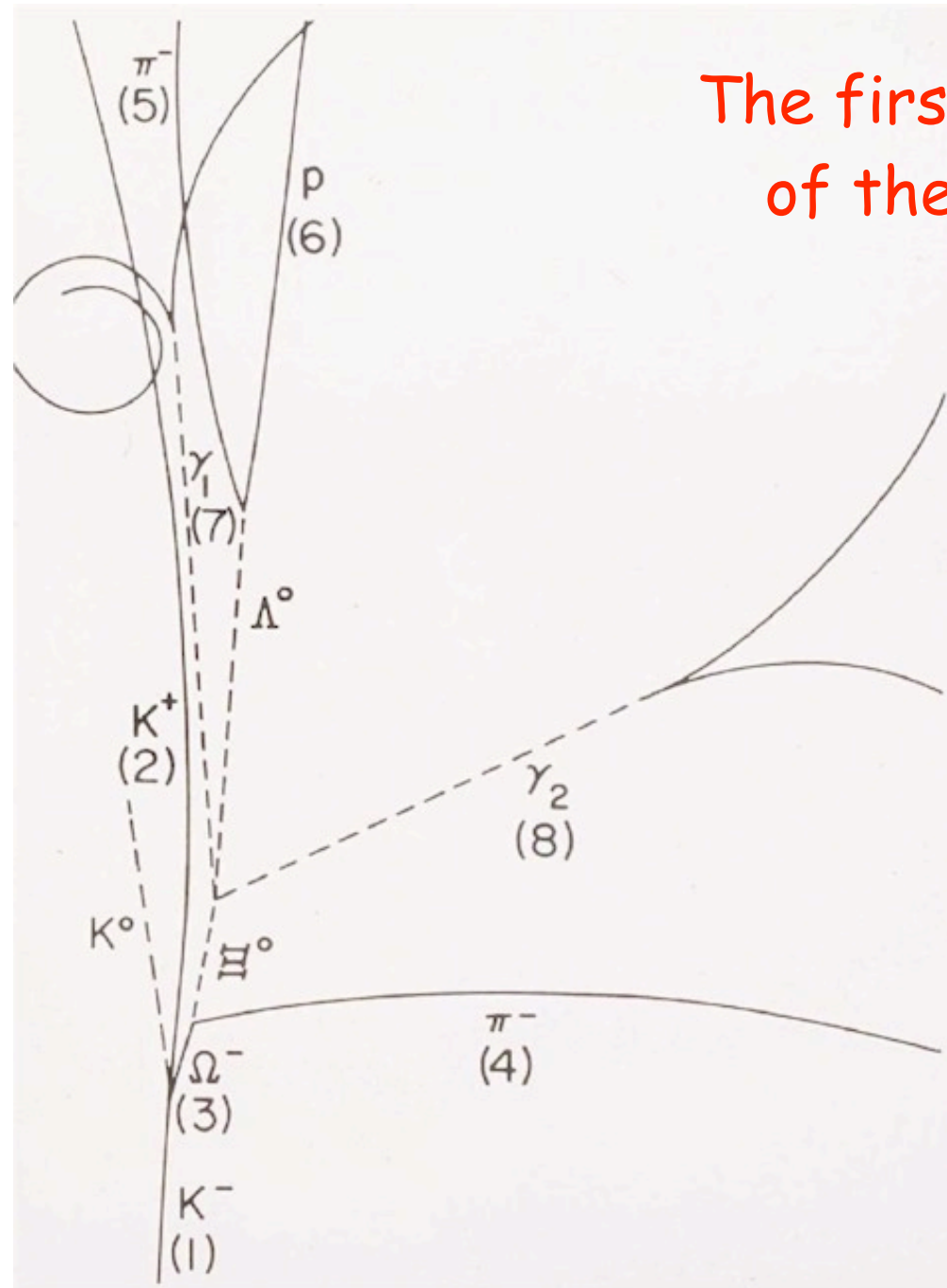


Astronomy picture of the day; Saturn's Rings in Natural Color

23/7/04



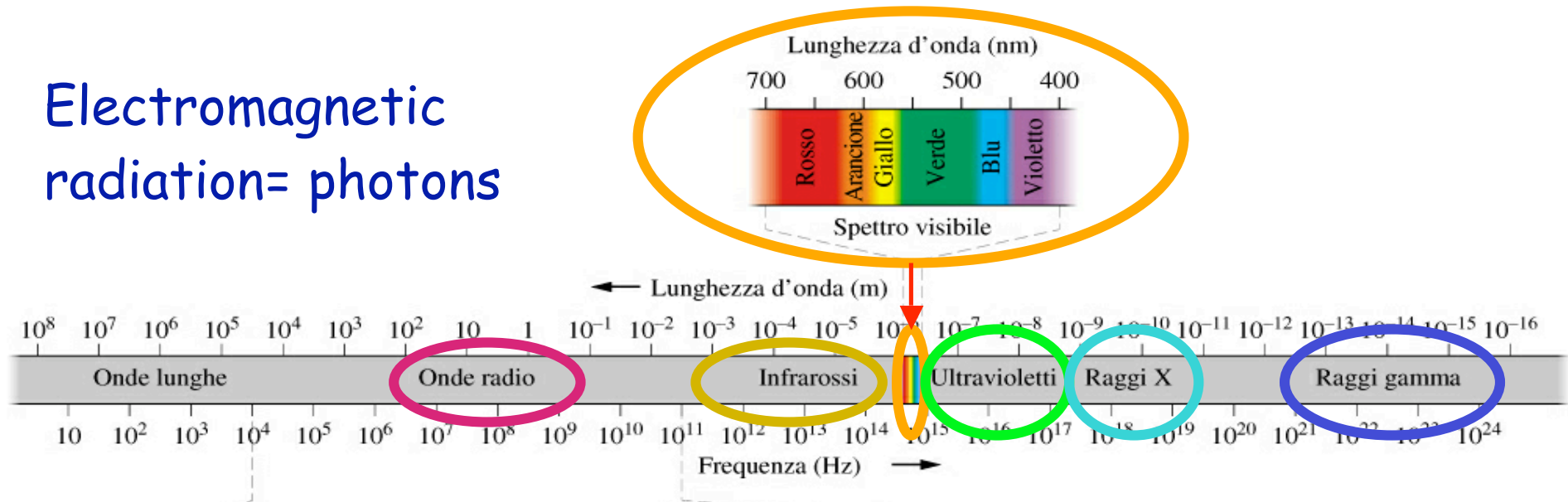
The first observation
of the Ω^-



New instruments for Astrophysics

Astronomers detect the *electromagnetic radiation*, which is the source of informations

Electromagnetic radiation = photons



(Astro)Physicists are opening new methods of investigation with the detection of new particles (*neutrinos*) which interact very little.

Electrosmog (Electromagnetic pollution)

Electrosmog: a term that generates wide discussions

Electricity, smoke, fog???

Electric power and electromagnetic waves

What are they and where do they come from?!

Interactions of the electromagnetic waves with matter

What do they generate?

Natural and artificial electromagnetic radiations

Why only artificial ones scare people?

Can "electrosmog" be measured, and who is in charge of it?

Can we trust the experts specifically prepared for it?

Can "electrosmog" be reduced?

Certainly, but how and how far?

Which interventions could improve the present electrosmog background?

Which difficulties are to be faced?



Where to look for updated and adequate information?

Satellite
photo of the
Etna eruption
in July 2002.

*(Credit: Kathy
Strabala and
NASA)*



4. Conclusions

- Science and technology play an increasing role in our lives
- Advances in modern science occur very quickly
- It is generally agreed that education and awareness in science have to be strengthened in modern society. Scientific outreach, improvements in teaching, proper scientific informations have become very important
- The main motivation for basic research remains scientific curiosity
- Because of the large costs Proper Public Relations in Big Science are now essential
- The techniques used in physics, even in particle physics, can be applied to medicine, ... and thus improve the quality of our lives



scienza **giovane**

BOLOGNA:
UNIVERSITÀ ANTICA.
SCIENZA GIOVANE

NEW!

INDICE ARGOMENTI

LETTURE

WEBCAST

LINK

RIVISTE SPECIFICHE

SITI DIVULGATIVI



La finestra
radio sul
cosmo



Transito
di Venere



Gli scienziati
bolognesi



Elettromog



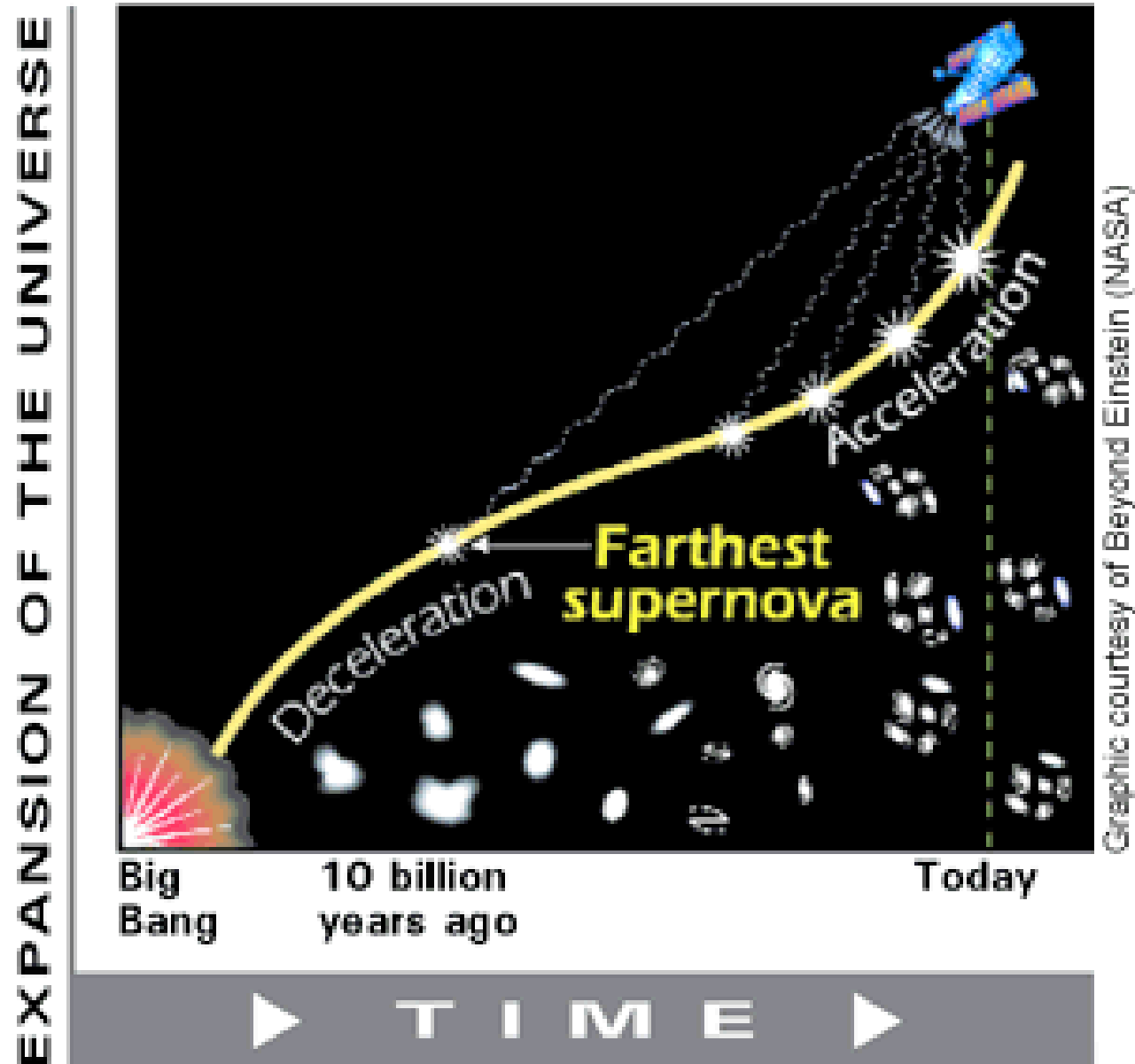
La materia
oscura



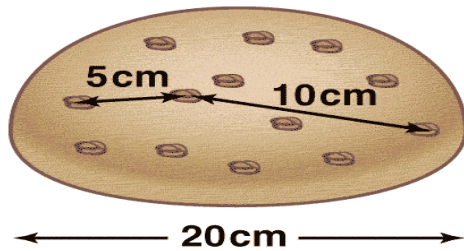
L'Università di Bologna per la Divulgazione Scientifica.

Questo sito web è rivolto principalmente a studenti degli ultimi anni delle medie superiori e dei primi anni di Università e ha lo scopo di sensibilizzare i giovani su argomenti di attualità scientifica e tecnologica.

Expansion of the Universe

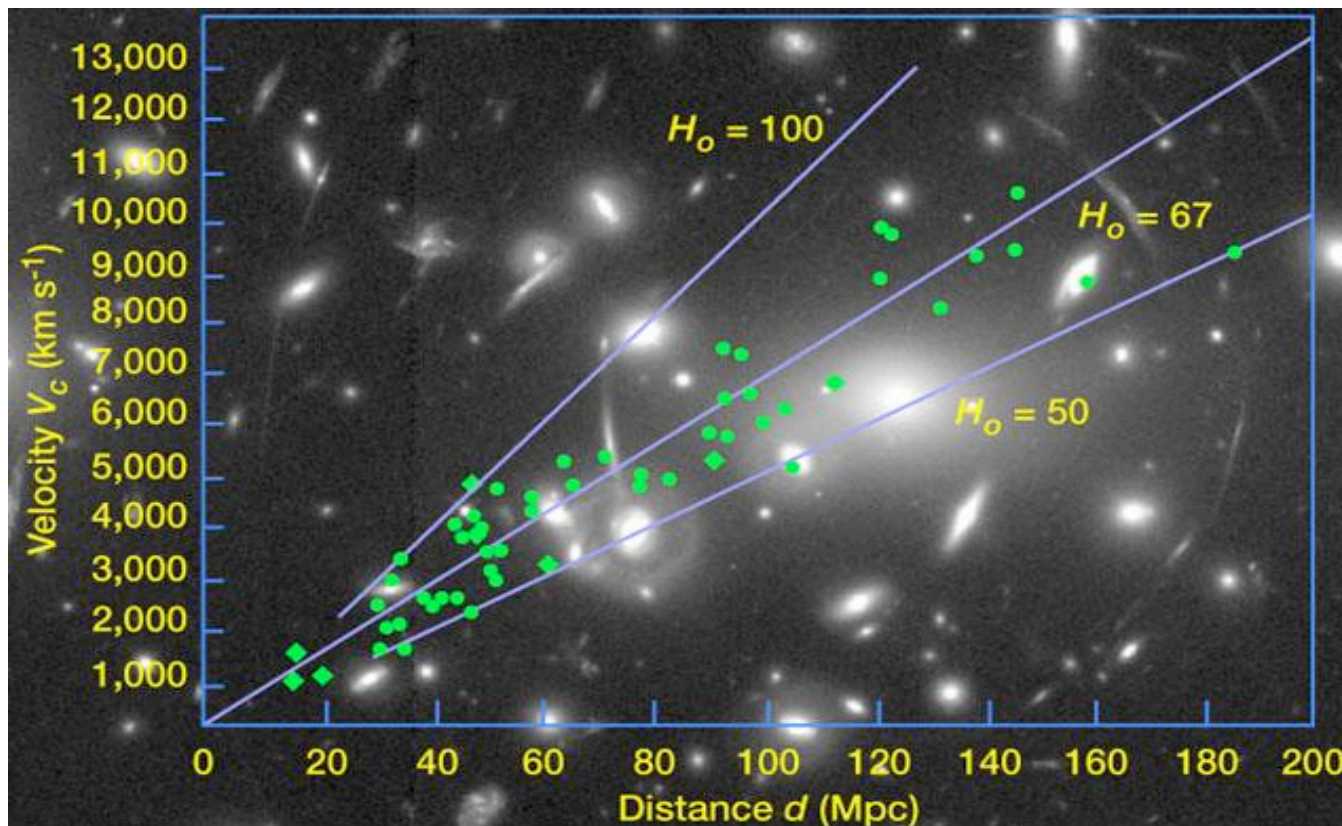


L'Universo e' sempre stato così? 1



MAP990404

L'Universo è in **espansione** Ogni Galassia si allontana da tutte le altre, con una velocità che aumenta con la loro distanza (Legge di Hubble)



NOTA: è possibile misurare velocità di stelle e Galassie tramite un fenomeno fisico chiamato *effetto Doppler*