



«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE
TO PAY A PERMANENT TRIBUTE TO GALILEO GALILEI, FOUNDER OF MODERN SCIENCE
AND TO ENRICO FERMI, THE "ITALIAN NAVIGATOR", FATHER OF THE WEAK FORCES



INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS
55th Course: Highlights from LHC and the Other Frontiers of Physics

Erice, 14 – 23 June 2017

THE FUTURE OF OUR SCIENCE

ANTONINO ZICHICHI

Pontifical Academy of Sciences, Vatican City

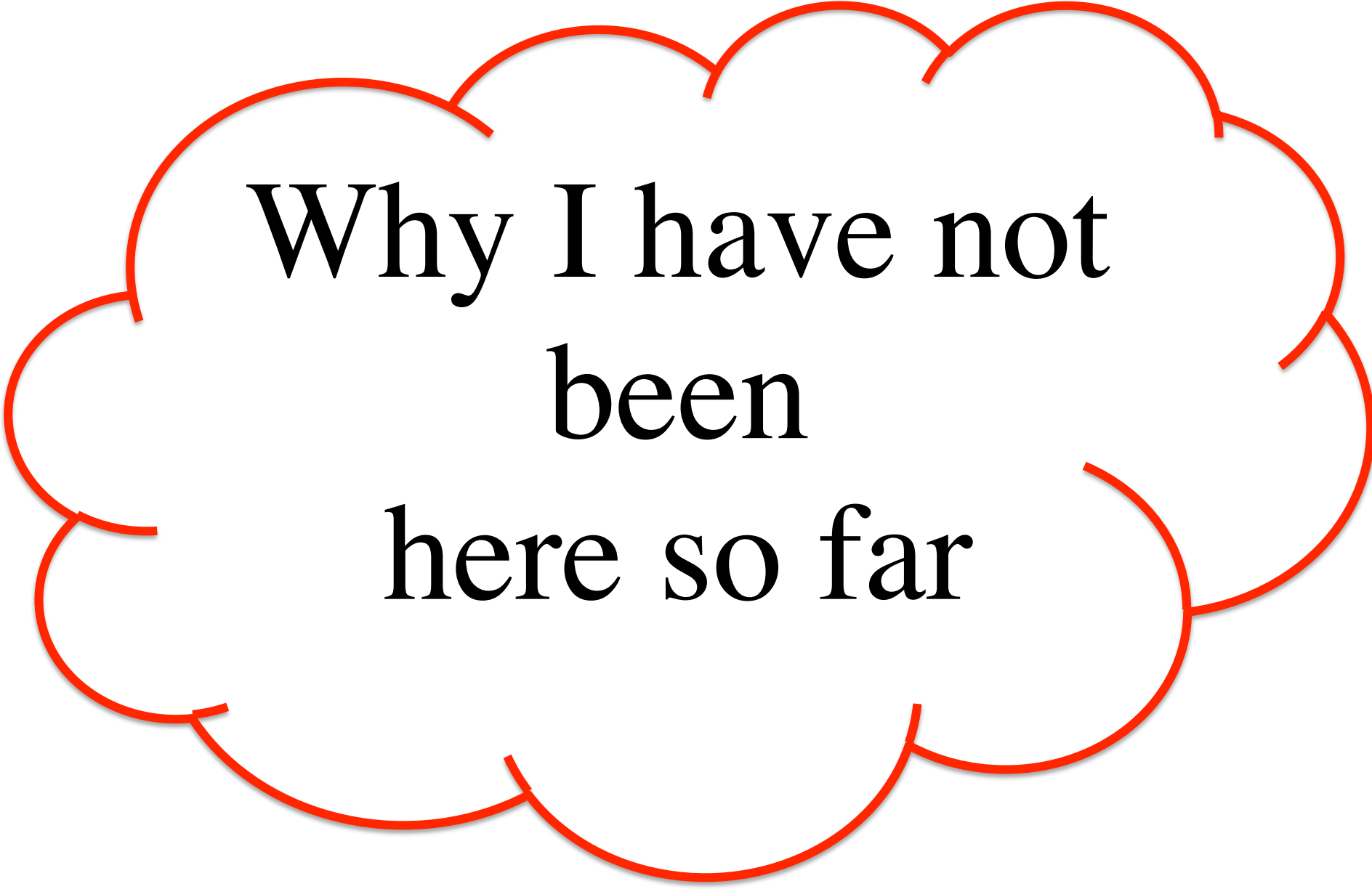
INFN and University of Bologna, Italy

CERN, Geneva, Switzerland

Enrico Fermi Centre, Rome, Italy

World Federation of Scientists, Beijing, Geneva, Moscow, New York

17 June 2017 - Paul A.M. Dirac Lecture Hall – Patrick M.S. Blackett Institute



Why I have not
been
here so far

I could not say

NO

to

a great friend

of

Physics



**The father of Renormalization
– Professor Gerardus 't Hooft –
has, in his
Opening Lecture,
recalled some interesting cases
where memory loss has occurred
in the form of living matter
to which we belong.**



I will mention
only one case
occurred in the year 2000.

Italy
had forgotten

ENRICO FERMI.

On many occasion I had given lectures
in order to convince the Audience that
the father of the

Uranium Fission bomb (Hiroshima)
and of the

Plutonium Fission bomb (Nagasaki)
was **Adolf Hitler not Enrico Fermi.**



Fortunately for us
the Minister of Science of the time
was **Professor Ortensio Zecchino**,
a high cultivated politician.
Despite the strong opposition
of very many so called “scientists”
who had never done “Science”
Zecchino asked me to make
a concrete proposal.



This is how
I worked out
the Project for a new Institution,
to celebrate the 100th Anniversary
of Enrico Fermi
creating the
Enrico Fermi Centre
for real
Interdisciplinary Research Activities.

Where?

Exactly in the same Institute
where **Enrico Fermi**
was working
in the years '30 of last century.



Problem:

The Institute was entirely occupied
by very smart people
devoted to defend Italy
from illegal thinking, like

ESPIONAGE



Result:

The Enrico Fermi Centre
has been established
thanks
to **Zecchino**
in the year 2001.



The same fellow asked me to invent a Project in order to study the scientific linking of the

• **Dinosaurs**

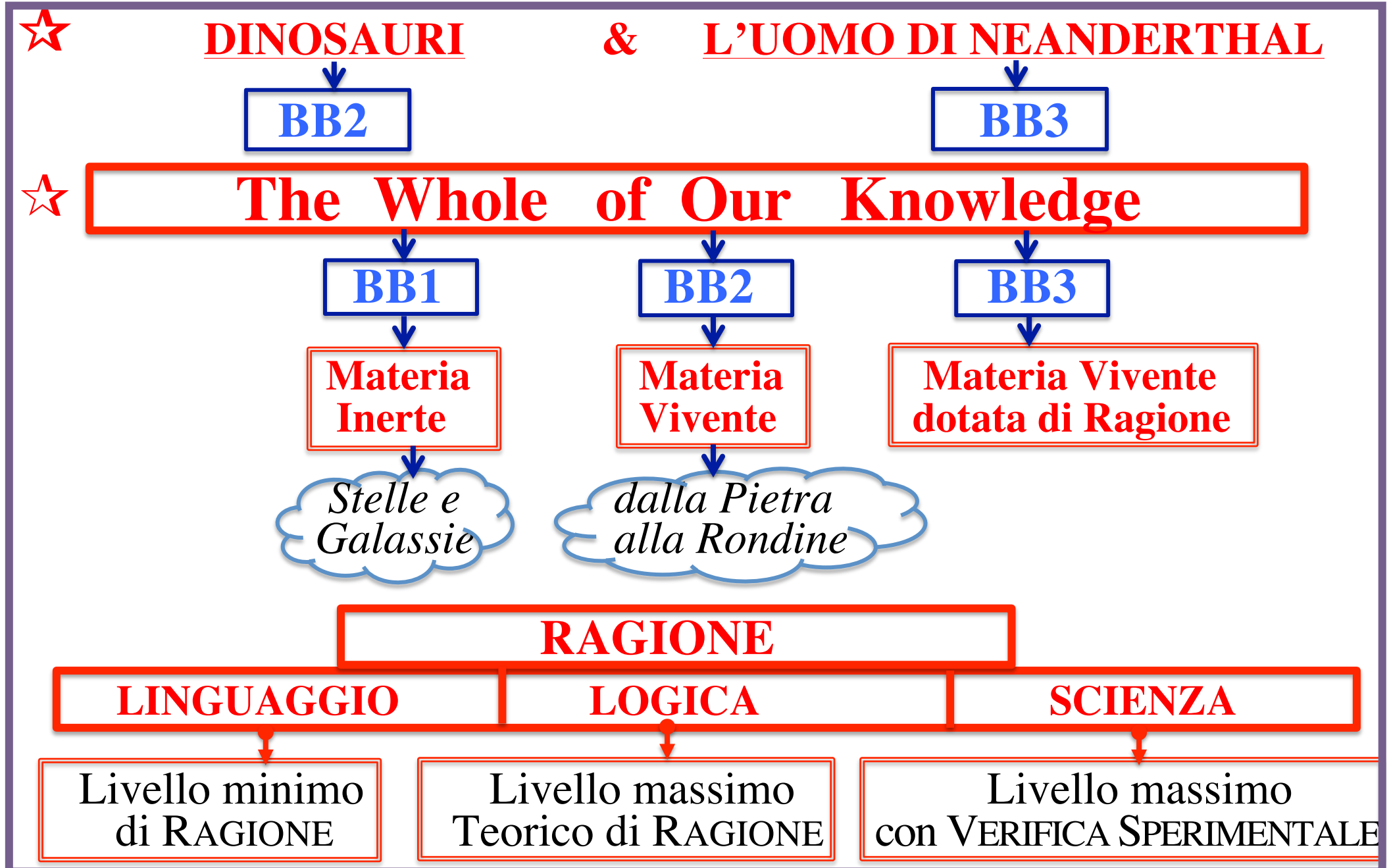
and the

• **Neanderthal Man**

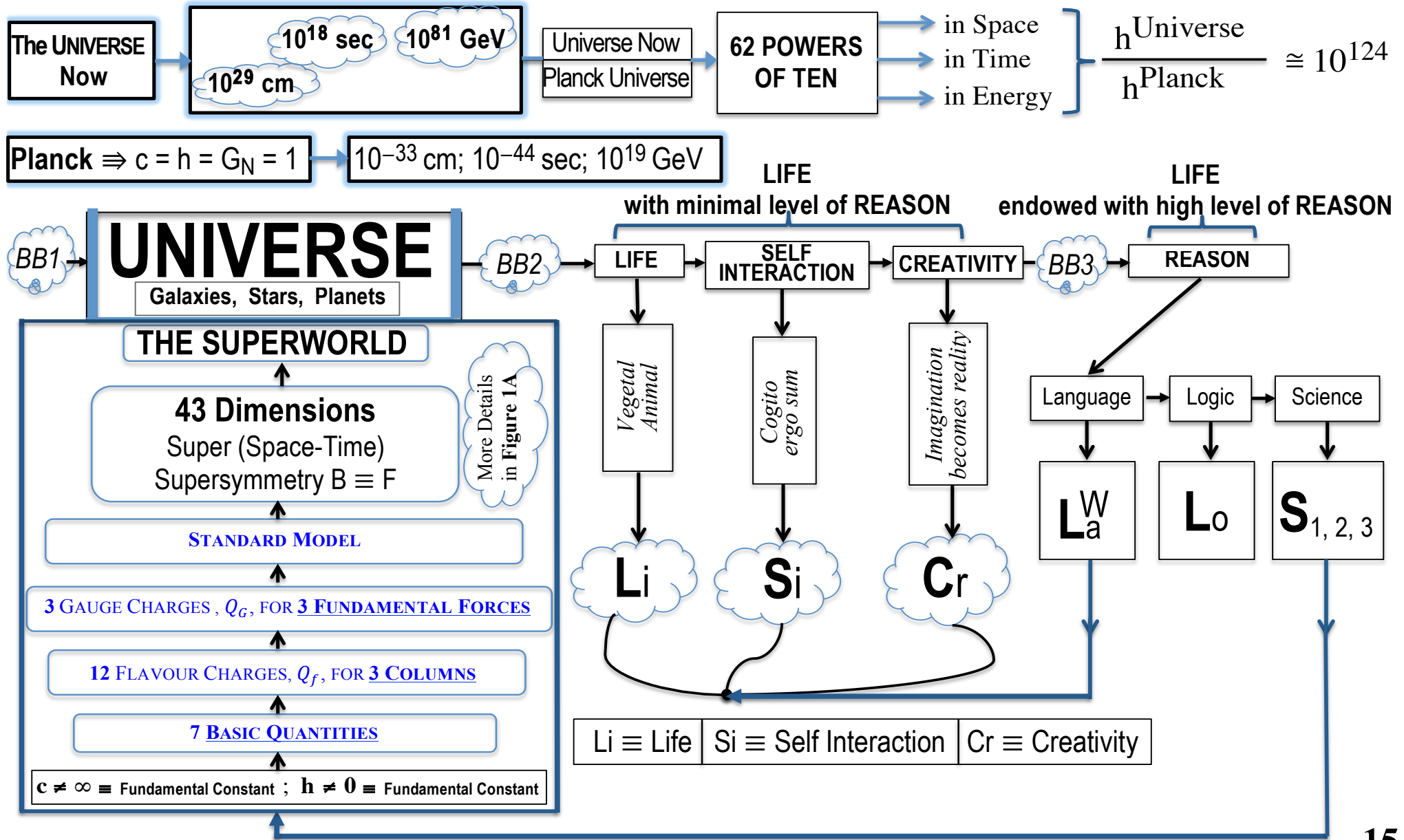
with

BB(1), BB(2), BB(3).

Here is
the synthesis
of the
Project.



THE WHOLE OF OUR KNOWLEDGE AND THE THREE BIG BANGS



THE THREE BIG BANGS

BB1

⇒ *from Vacuum to the Universe of Inert Matter*

BB2

⇒ *from Inert Matter to Living Matter*

BB3

⇒ *from Living Matter to Living Matter with Reason*

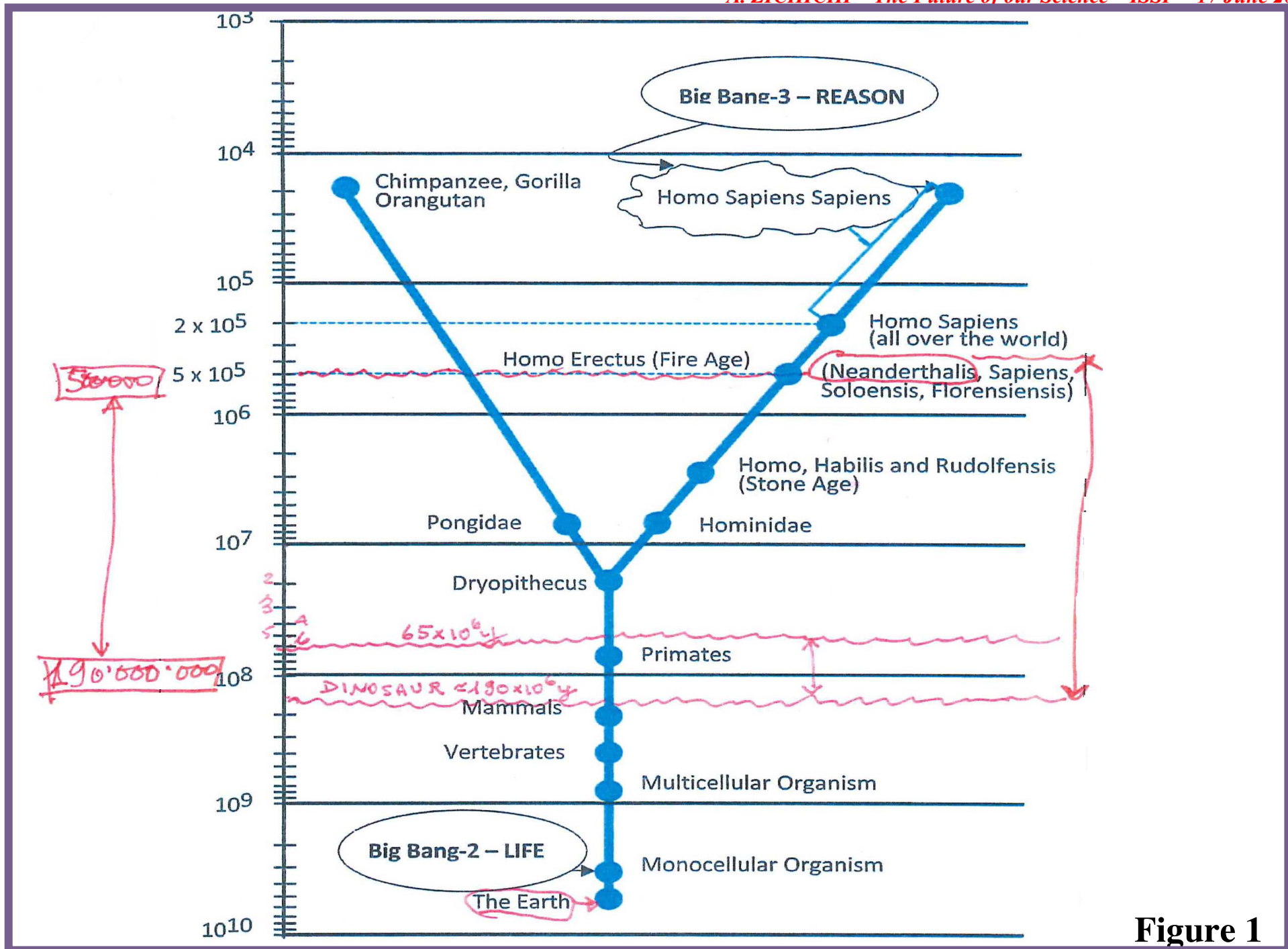


Figure 1 17

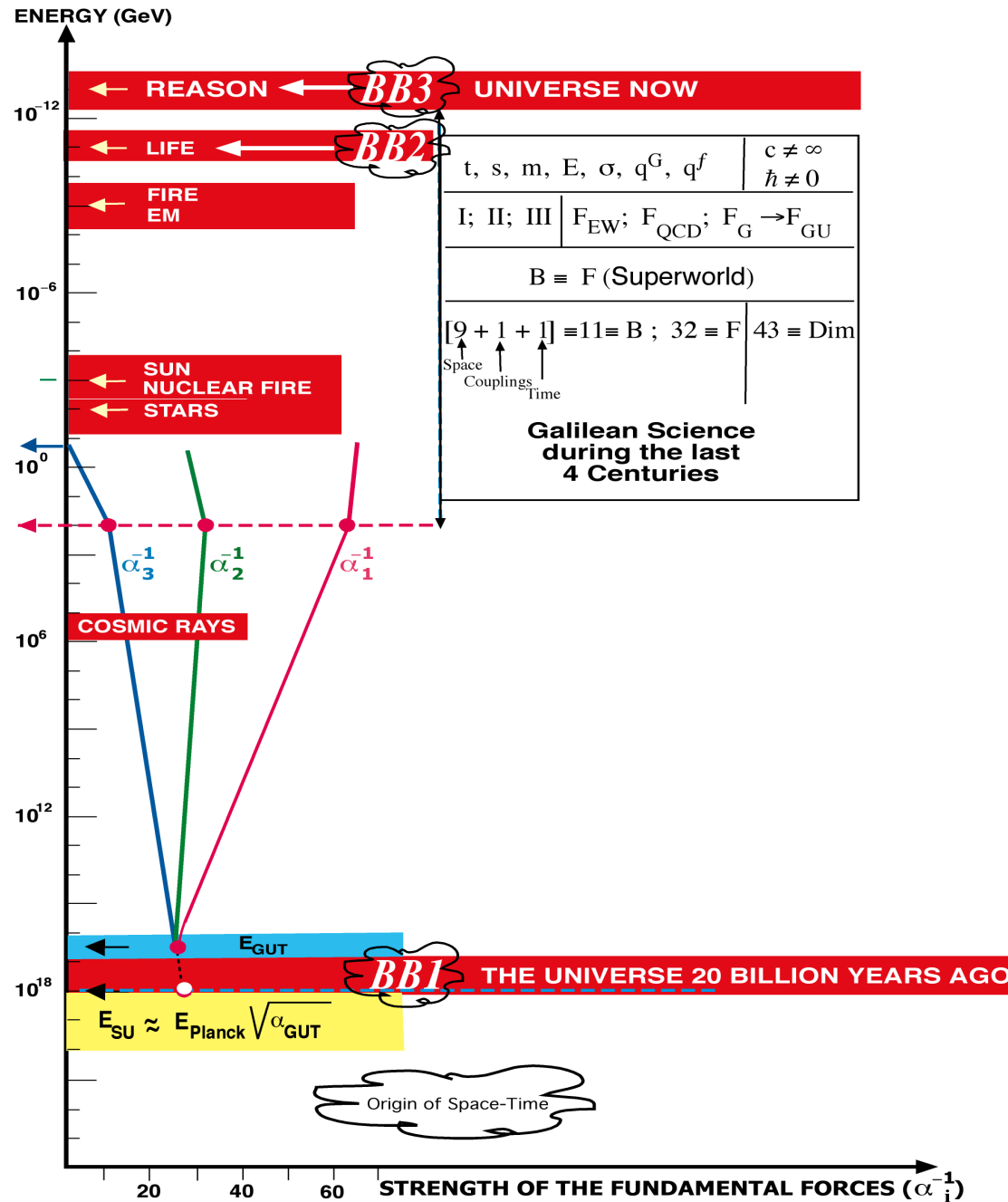
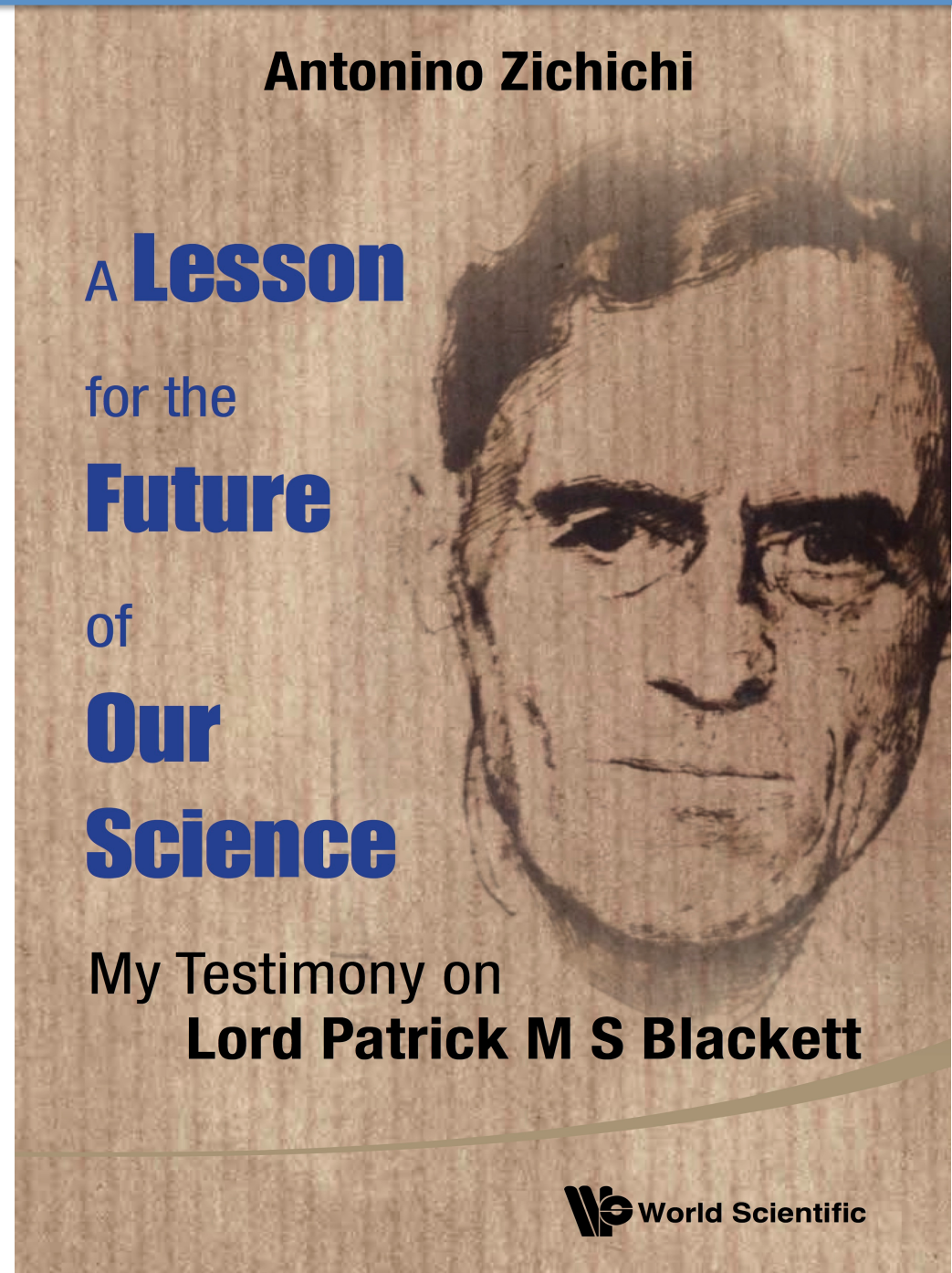


Figure 2

Please read the
Chapter XII
of my book



XII – HOW THINGS REALLY HAPPEN

Certainly **not** as it is often reported and believed to be true. Let me give a few examples.

① Very few people know how it happened that the UK Government – who was not willing to support the Rabi's proposal at the Unesco 1950 Conference in Florence to create a European Laboratory, CERN – changed its position and decided to support the establishment in 1954 of CERN in Geneva.

I was often in Professor Blackett's office. The topics were the new frontiers of Physics, dominated by the existence of a new fundamental charge of Nature, called "strangeness". As we have seen these new frontiers were all coming from the discovery of the very strange events, named by Blackett "V-particles". Fermi's criticism had to be solved. If it is really true that a new "**charge**" exists, why it is so difficult to find the proof so much wanted by Enrico Fermi? Why in the cosmic rays had no one observed the associated production of a pair of "heavy mesons" (called θ -particles at the time) with positive and negative "strange" charge? In the USA a new accelerator was working at the high energy needed to produce pairs of these mesons. But no evidence had been observed for the pair production of strange mesons. After all we should not forget that the decisive proof concerning the production of electric charges was the experimental discovery by Blackett and Occhialini, in 1932, of the pair

15 October 2016

**Polish Parliament
Closing Lecture**

**THE NEW
MANHATTAN PROJECT**

A. Zichichi

**Wigner
Fermi
Dirac
Kapitza
Teller
Oppenheimer**



THE NEW MANHATTAN PROJECT

Science for Peace the World Over



ANTONINO ZICHICHI

University of Bologna and INFN, Italy

CERN, Geneva, Switzerland

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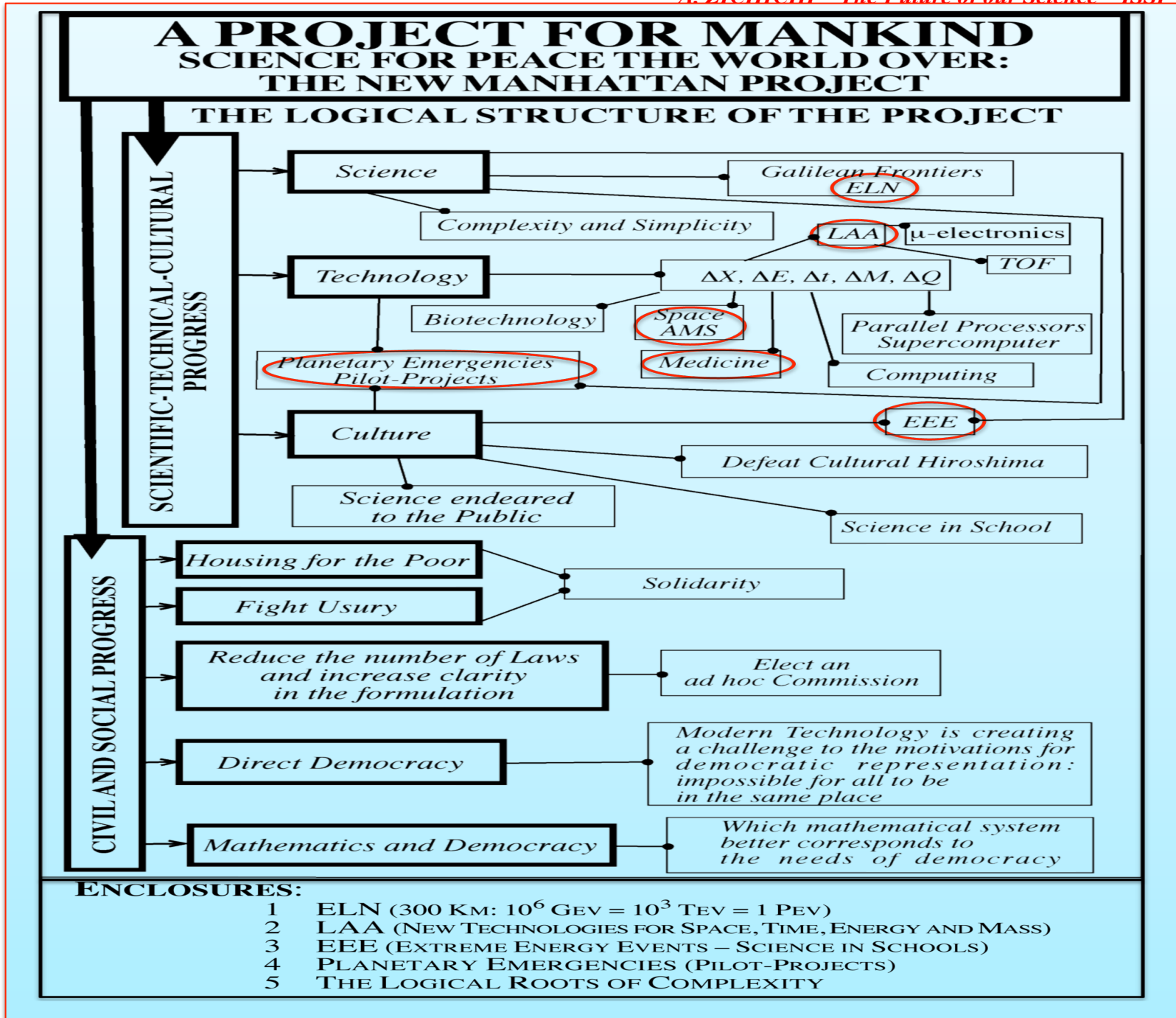
Pontifical Academy of Sciences, Vatican City

World Federation of Scientists, Beijing, Geneva, Moscow, New York

Ettore Majorana Foundation and Centre for Scientific Culture, Erice, Italy

**The
fathers
of
the New
Manhattan
Project**

**THE FUTURE OF OUR
CIVILIZATION
HAS ITS ROOTS IN OUR LABS**



THE NEW MANHATTAN PROJECT

Science for Peace the World Over

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ANTONINO ZICHICHI

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In the Opening Lecture at the
EPS Conference in Geneva
(EPS Proceedings of the 1979 EPS
Conference), in the chapter devoted to
“The Lesson from Past Deserts”,
it is reported that “not very many
people would have bet on the existence
of the 9,5 GeV object discovered by
Lederman et al. at Fermilab”.

This discovery (1977) was presented at the “Ettore Majorana Centre for Scientific Culture” in Erice to celebrate the 15th Anniversary of the International School of Subnuclear Physics Ettore Majorana, and it was **“the most spectacular news”**.

Robert R. Wilson,
a strong supporter of the Erice Centre,
Director of Fermilab,
was in Erice
celebrating
the totally unexpected discovery.

On the occasion of
the 50th Anniversary of the Fermilab,
I would like to recall
the extraordinary contributions of
Bob Wilson
to let the Culture of our time
understand that the motor for progress
is
“scientific discovery”.

Being Physics
the queen and mother
of all Sciences
(Fermi *dixit*)
it is our responsibility
not to remain silent
when the great public
is bombarded with problems
which seem to be very far away
from our activity.

In 1972 at Fermilab,
Bob Wilson
organized a conference
and invited
Dick Feynman,
Vicky Weisskopf
and myself
to discuss
“The Meaning of Culture”.

A very large number
of people came
and their interest
was the reason why
Bob Wilson
convinced me
that we should have,
in Erice, a Seminar
devoted to the same topic.

This took place
40 years ago
(August 1977)
and specialists
in other fields were invited.

Not only
Physics but,
Medicine,
Mathematics and
Fine Arts
specialists were present
at their highest levels.

Let me quote a few names:

Sir John Eccles (Nobel in Medicine), René Thom a famous French mathematician (Field Medal), René Berger (President of the World Association of “Art Critics”).

Bob Wilson
is not only a distinguished scientist
and the father of Fermilab
but also a great physicist
who was engaged in a project
whose purpose was to avoid that
either Hitler or Stalin dominate Europe,
i.e. the Manhattan Project.

Bob was also
a sculptor and an architect:
the spectacular building
at Fermilab is his signature.

Half a century later
his ideas for
the Culture of our time
are very much needed.

We physicists
cannot remain silent
when the great public
is bombarded
with topics
such as:

Complexity is the New Science,



**the Reductionism
is over,**

all Sciences
must be
Holistic,

the Artificial Intelligence
will overcome
the Human Intelligence,

Chaos is the origin of Life.

(see later page 90, Petermann and Zichichi)

In addition to these
general topics
the great public
is bombarded with
problems concerning
everyday's life:

traffic
flux

internet
network

earthquakes and seismicity

social and economic systems

the behaviour of financial markets

the Global warming

(see later page 91, Climate Evolution)

the energy crisis

the information security

the problems
concerning
the environment.

Any of these topics,
in order to be rigorously studied,
requires the same mathematics
needed for the convergence
of the three gauge couplings

$$(\alpha_1\alpha_2\alpha_3):$$

a system of at least three non-linear
differential equations, coupled.

☆☆☆ Such a system
has no analytic solution;
only mathematical models with
free parameters can be
constructed in order to simulate
the unknown analytic solution.
Each model needs
experimental verification.

We have to convince
the great public
that the solution to
all these **problems** requires
clarity and **rigour**
and that the best way
to study these problems
is through Science.

Since Physics,
as mentioned before,
is the “Queen of all Sciences”
(**Enrico Fermi**),
the solution of these
problems
needs physicists.

If it wasn't for the teaching
we have from the
Manhattan Project,
one could think that
what we do in our Labs needs
at least a century before
it becomes technology
in our everyday life.

We live in the
era of electronics.
This era came about
with the discovery,
by J.J. Thomson in 1897,
of the
“smallest piece of electricity”
which he called “electron”.

If, at that time, we had an International government capable of understanding the enormous consequences of this discovery, the electronics technology would have been available in our everyday life, five years later instead of a century. Five years is all it took for the Manhattan Project.

The Manhattan Project is the demonstration of how it is possible to go from a scientific discovery (nuclear fission) to nuclear technology in five years instead of the 100 years it took for the electronics technology.

The Manhattan Project was entrusted to the top scientists of that time.

Something else we came to learn from the Manhattan Project: how to avoid technological disasters.

During the few years
needed to go from nothing
to the realization of potent
nuclear technologies
(reactors and bombs),
there were no accidents.

The fathers of the Manhattan Project were considering the problems that could arise when the nuclear technologies they invented would fall under the control of standard Governments.

Three Mile Island, Chernobyl and Fukushima are the answers to the questions posed by the fathers of the Manhattan Project.

We should not remain silent but let people know that the future of our civilization must be based on the

“New Manhattan Project” i.e.
“*A Project for Mankind: Science from Peace the World Over*”.

In fact, it is the
scientific community of the
World Federation of Scientists
(WFS)
that has identified
72
Planetary Emergencies;

the target of all our actions
should be
to overcome
these emergencies using
the most advanced Centers
of rigorous knowledge such as
Fermilab in USA and
CERN in Europe.

Three years before
the fall of the Berlin Wall,
the WFS started interdisciplinary
activities for the study of the
Planetary Emergencies and the
elaboration of **pilot projects** to
overcome these emergencies.

A first analysis resulted in the identification of 15 classes of Planetary Emergencies.

Successive studies allowed, inside each class, to identify important details with a final result of

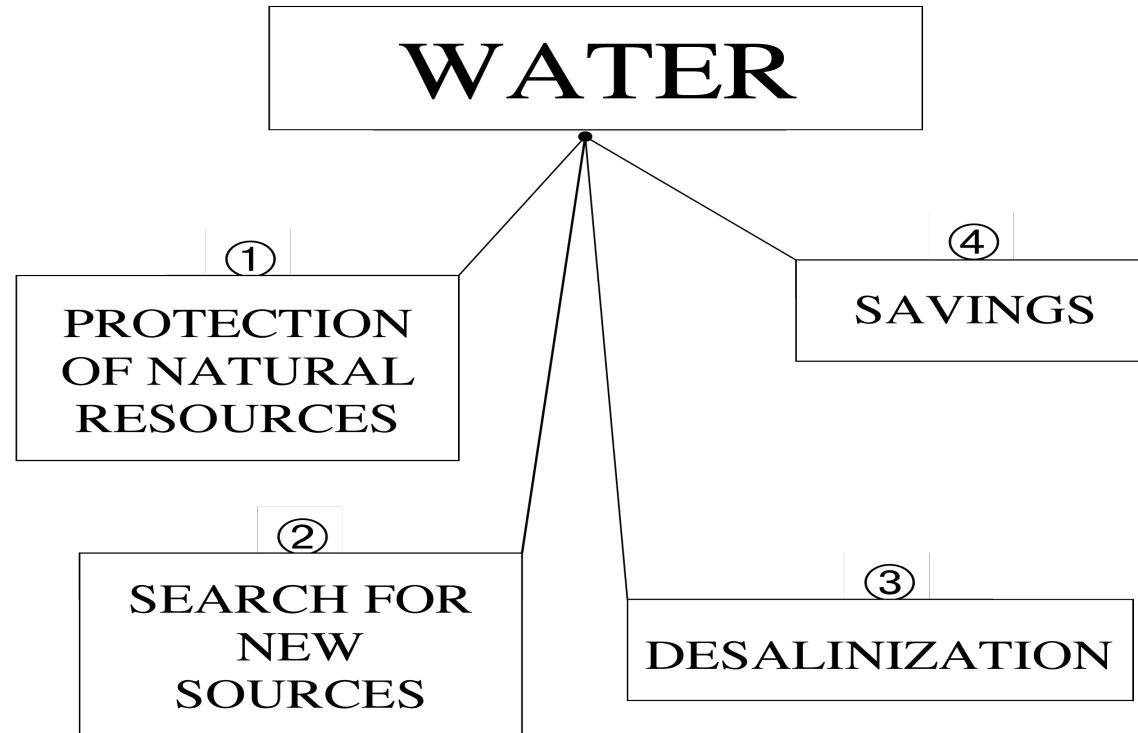
72 Planetary Emergencies.

THE 72 PLANETARY EMERGENCIES IDENTIFIED BY THE ERICE SCIENTISTS AND CLASSIFIED INTO 15 BASIC SOURCES		NUMBER OF SOURCES
I	<i>WATER</i>	4
II	<i>SOIL</i>	3
III	<i>FOOD</i>	5
IV	<i>ENERGY</i>	5
V	<i>POLLUTION</i>	7
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	Total	72



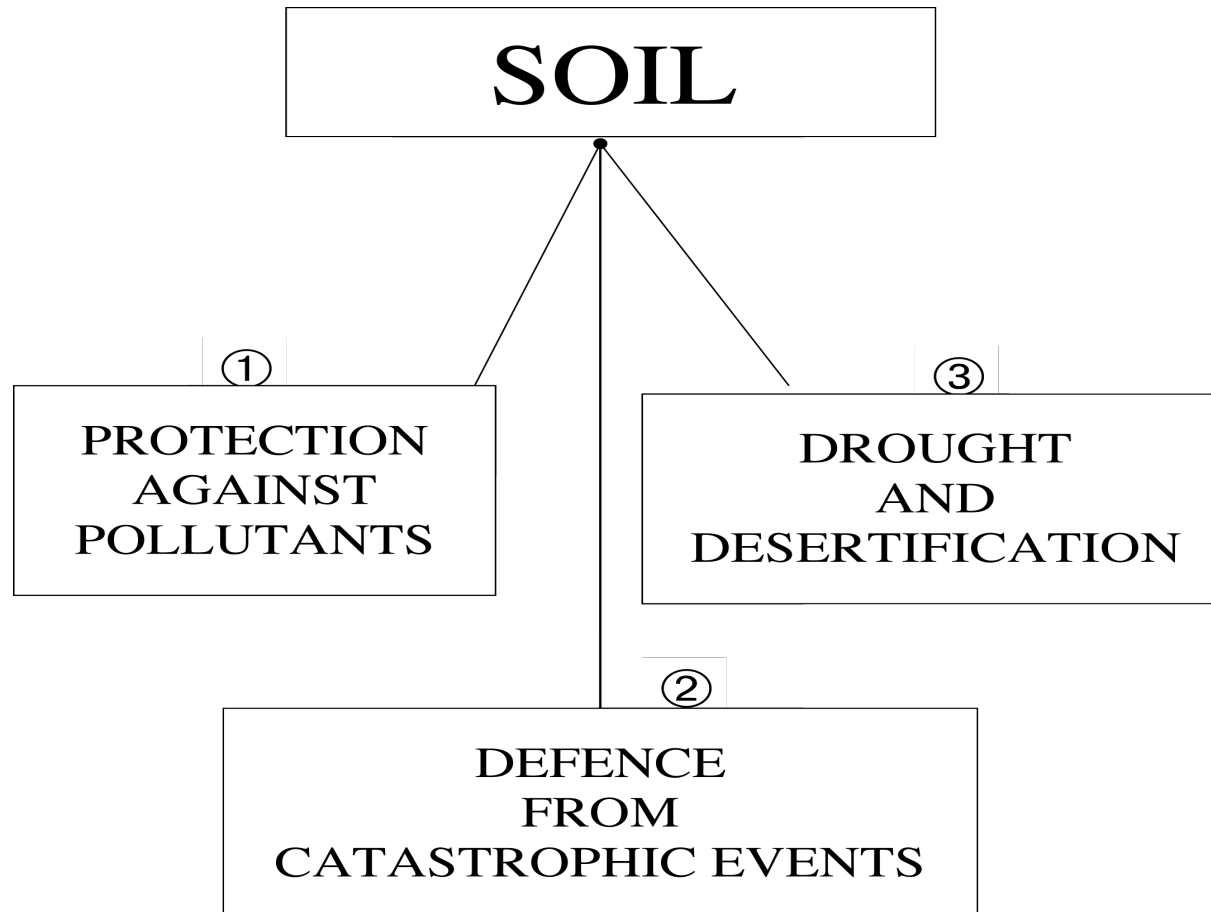
I

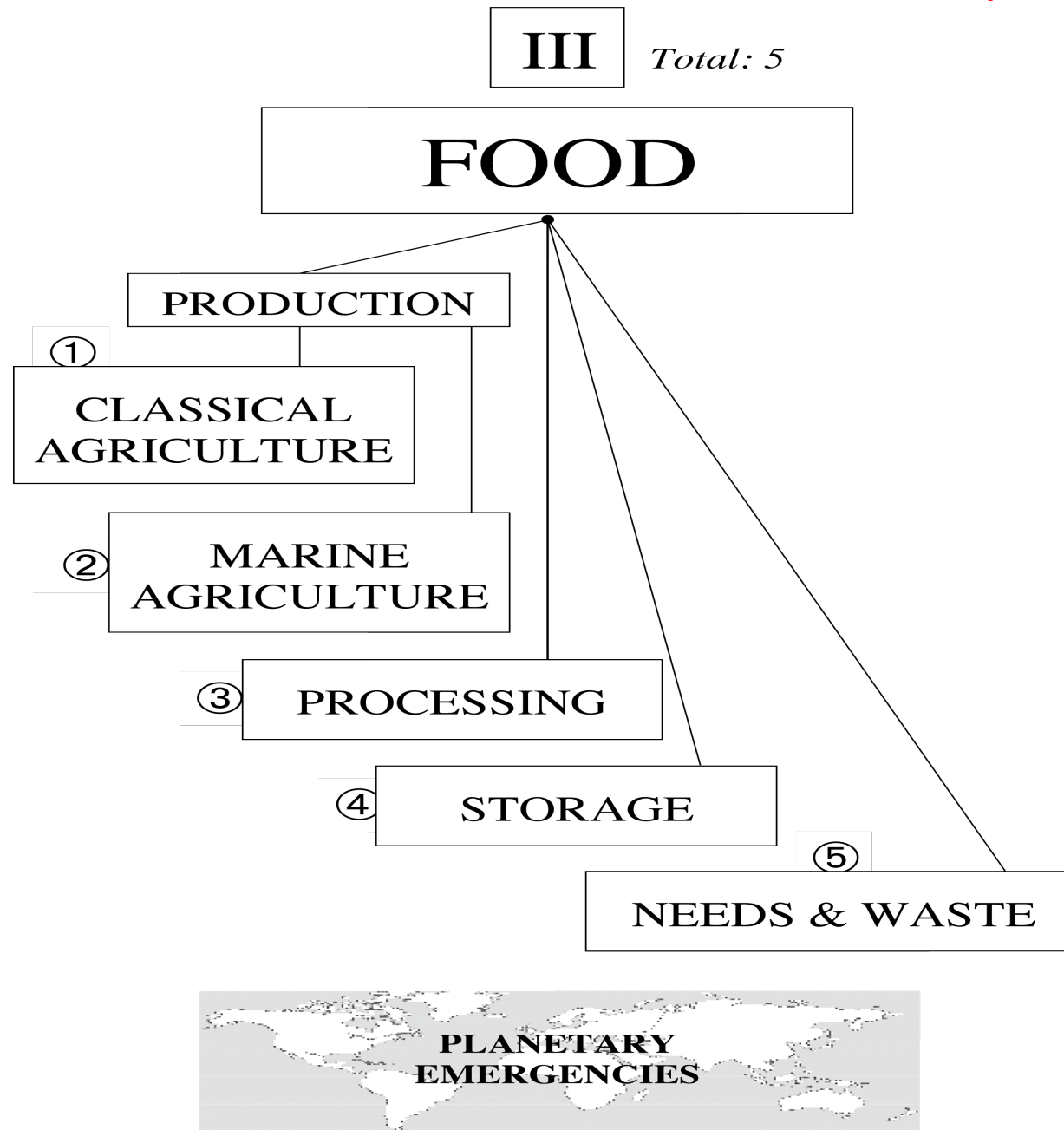
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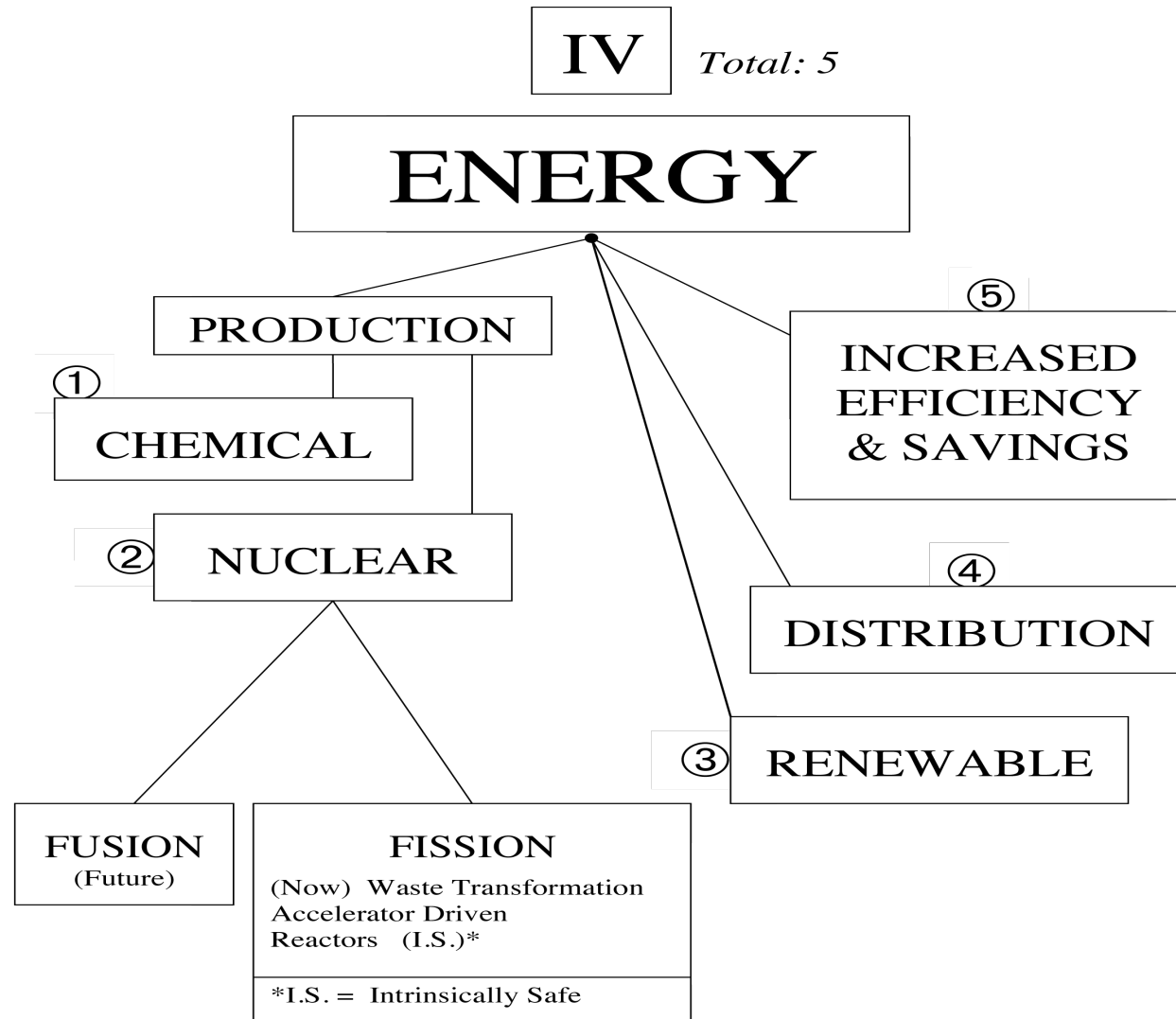


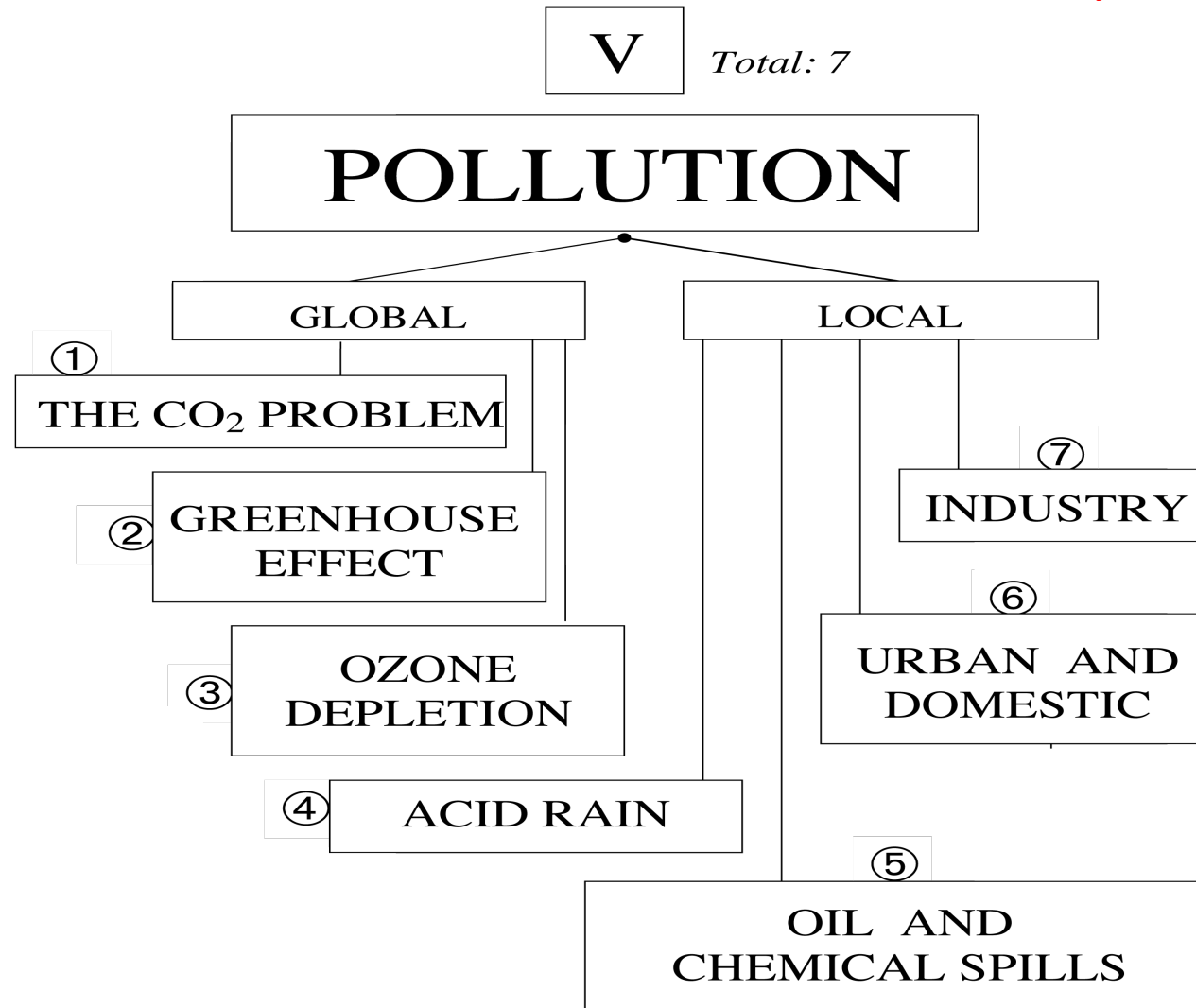
II

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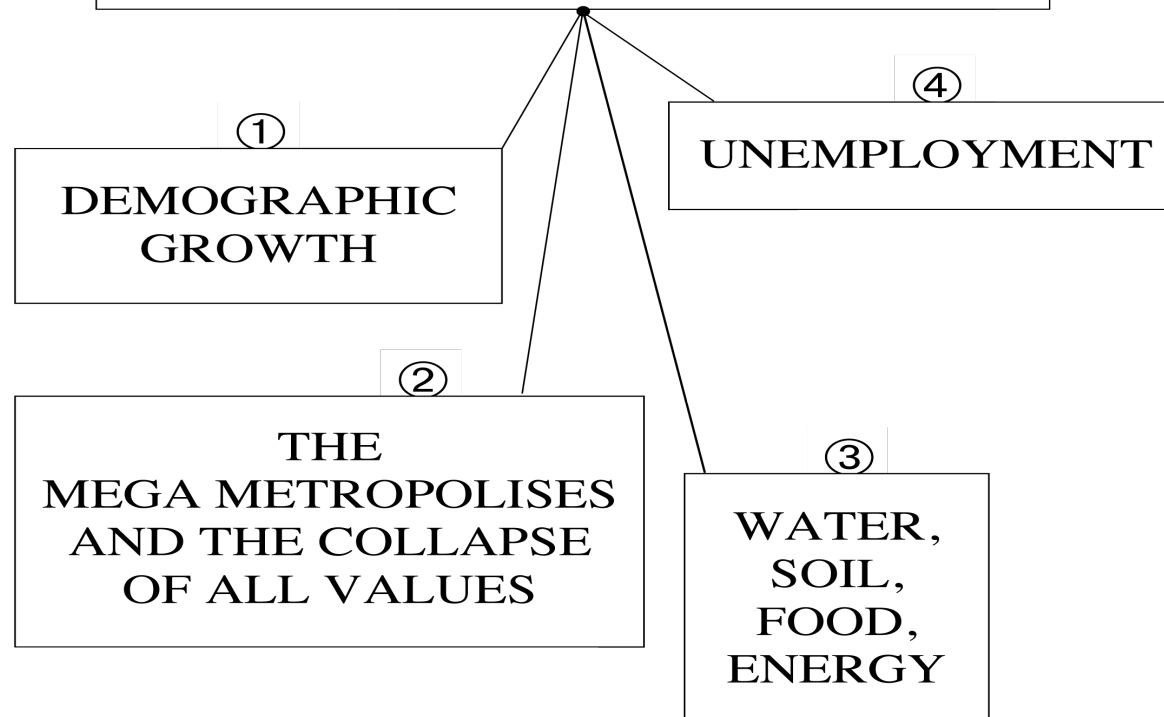




VI

Total: 4

LIMITS OF DEVELOPMENT



VII

Total: 5

CLIMATIC CHANGES

THE 1ST LEVEL SCIENTIFIC PROBLEMS

① THE MATHEMATICS
NEEDED TO SIMULATE THE
METEOROLOGICAL MOTOR

② THE EXPERIMENTAL DATA
NEEDED IN ORDER TO CHECK THE
VALIDITY OF THE PREDICTIONS

THE 2ND LEVEL SCIENTIFIC PROBLEMS (GLOBAL EFFECTS)

③ THE PROBLEM OF UNDERSTANDING
THE ORIGIN OF CLOUDS

④ THE EFFECTIVE CONSEQUENCES
OF COSMIC RAYS

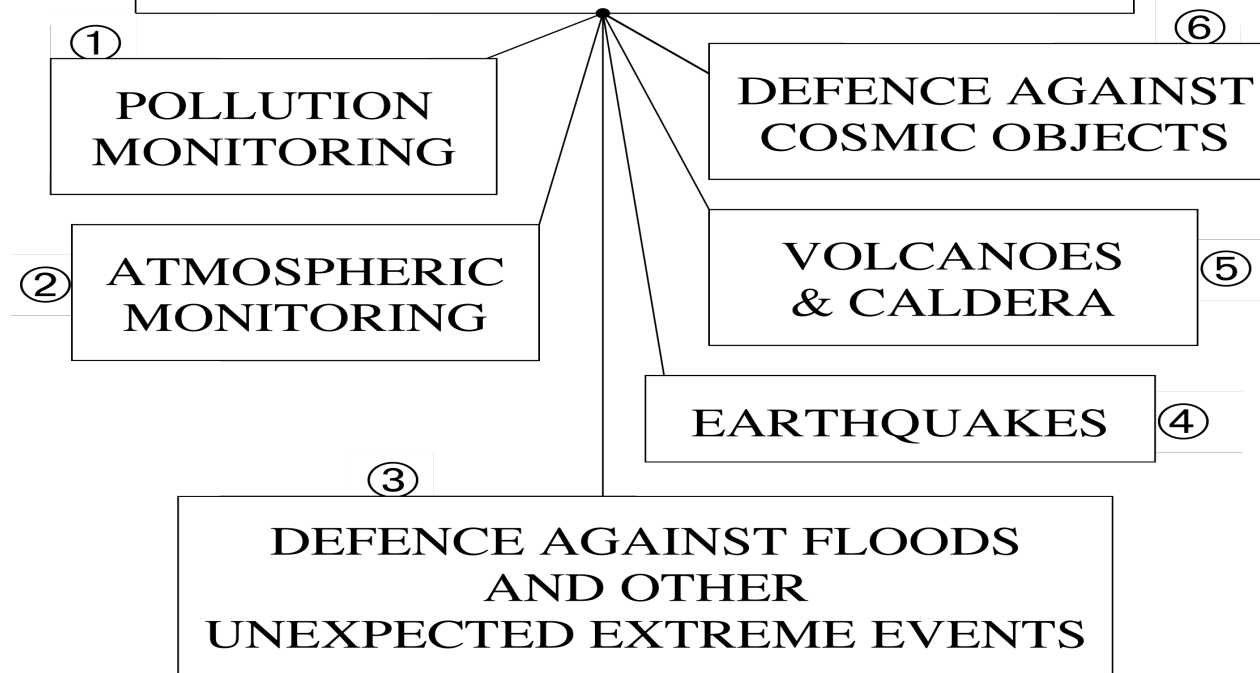
⑤ THE PROBLEMS OF NOW-CASTING,
MEDIUM-RANGE AND GALACTIC-RANGE



VIII

Total: 6

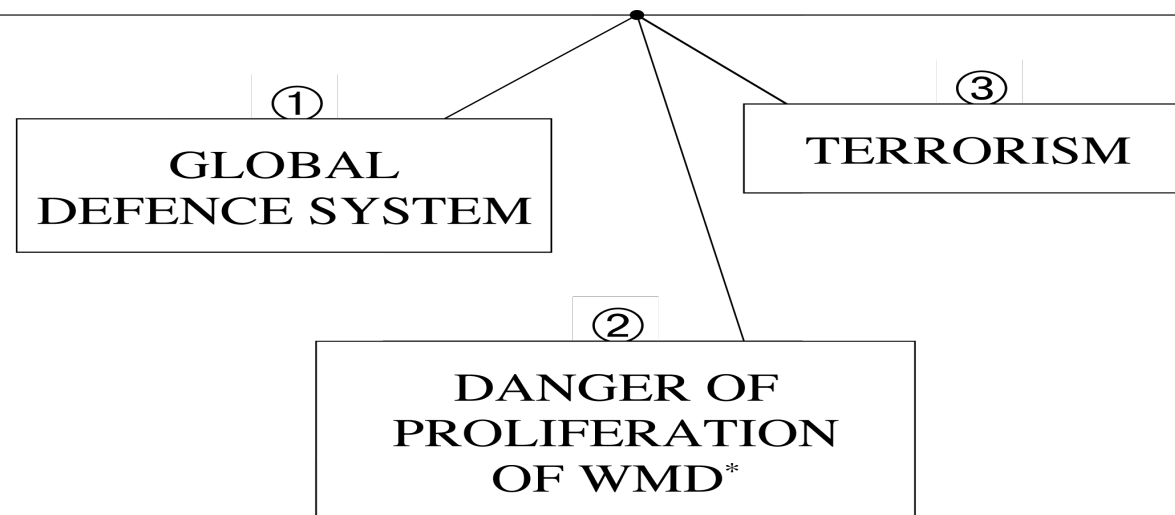
GLOBAL MONITORING OF THE PLANET



IX

Total: 3

NEW MILITARY THREATS IN THE MULTIPOLAR WORLD



*WMD = Weapons of Mass Destruction



X

Total: 3

SCIENCE AND TECHNOLOGY FOR DEVELOPING COUNTRIES TO AVOID A NORTH-SOUTH ENVIRONMENTAL HOLOCAUST

①

THE NATIONAL
SCHOLARSHIP PROJECT

②

SCIENCE WITHOUT SECRETS
AND THE PROBLEM OF
TECHNOLOGICAL DEVELOPMENTS
PRO AND AGAINST MANKIND

③

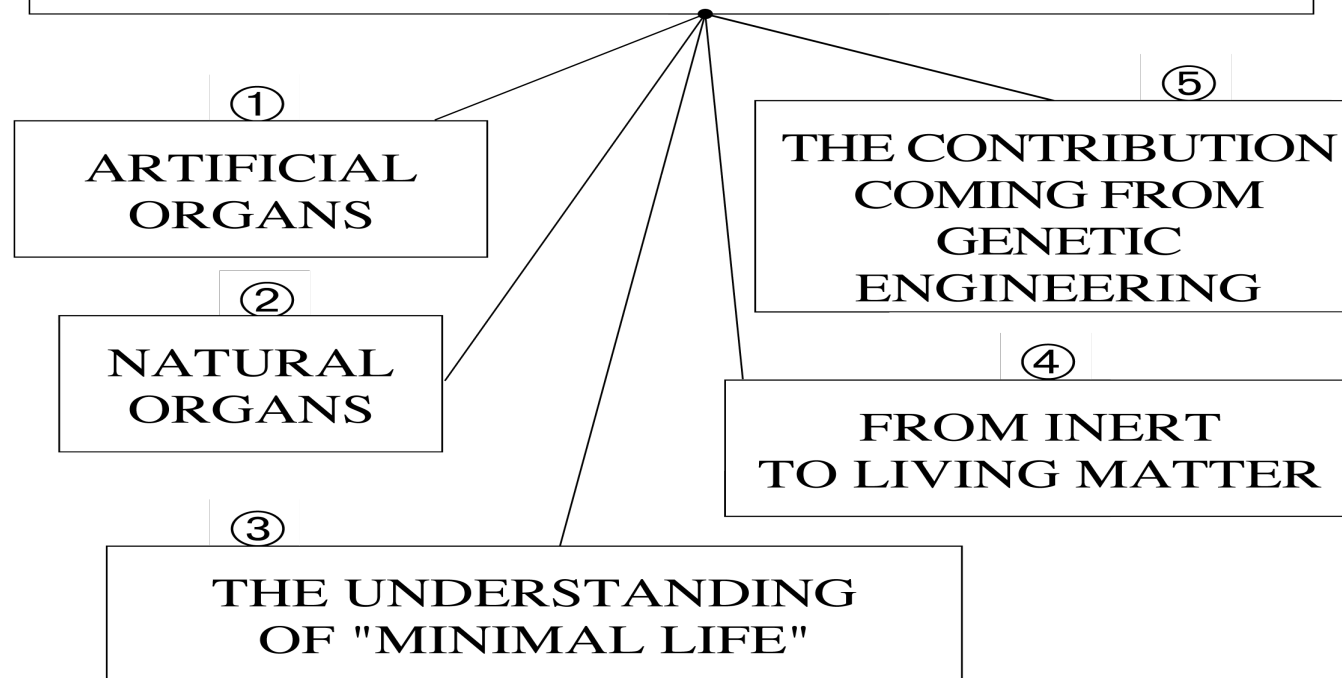
THE ROLE OF BIG
SCIENTIFIC RESEARCH CENTERS USING
INERT MATTER AND LIVING MATTER



XI

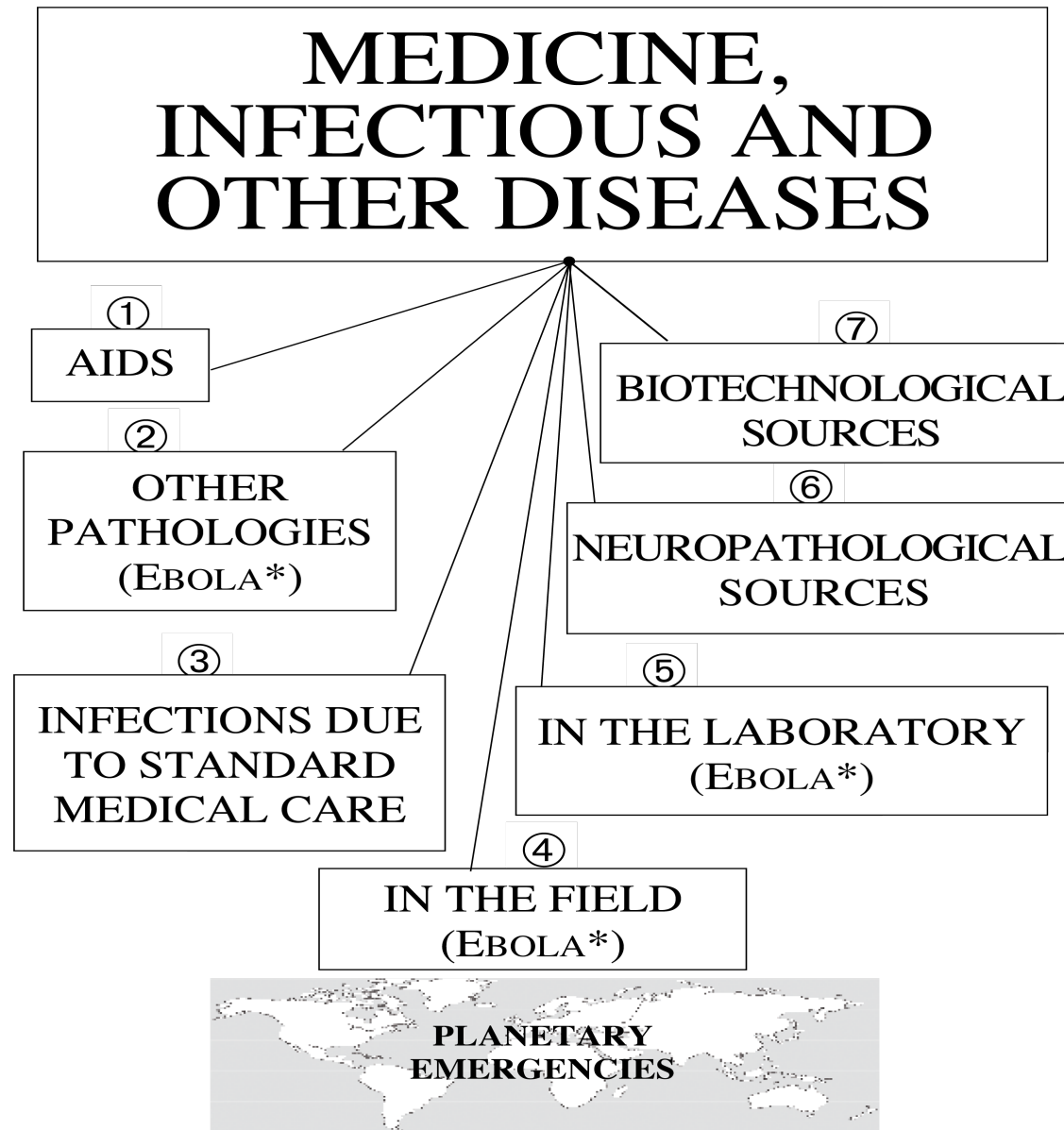
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THE PROBLEM OF ORGAN SUBSTITUTION



XII

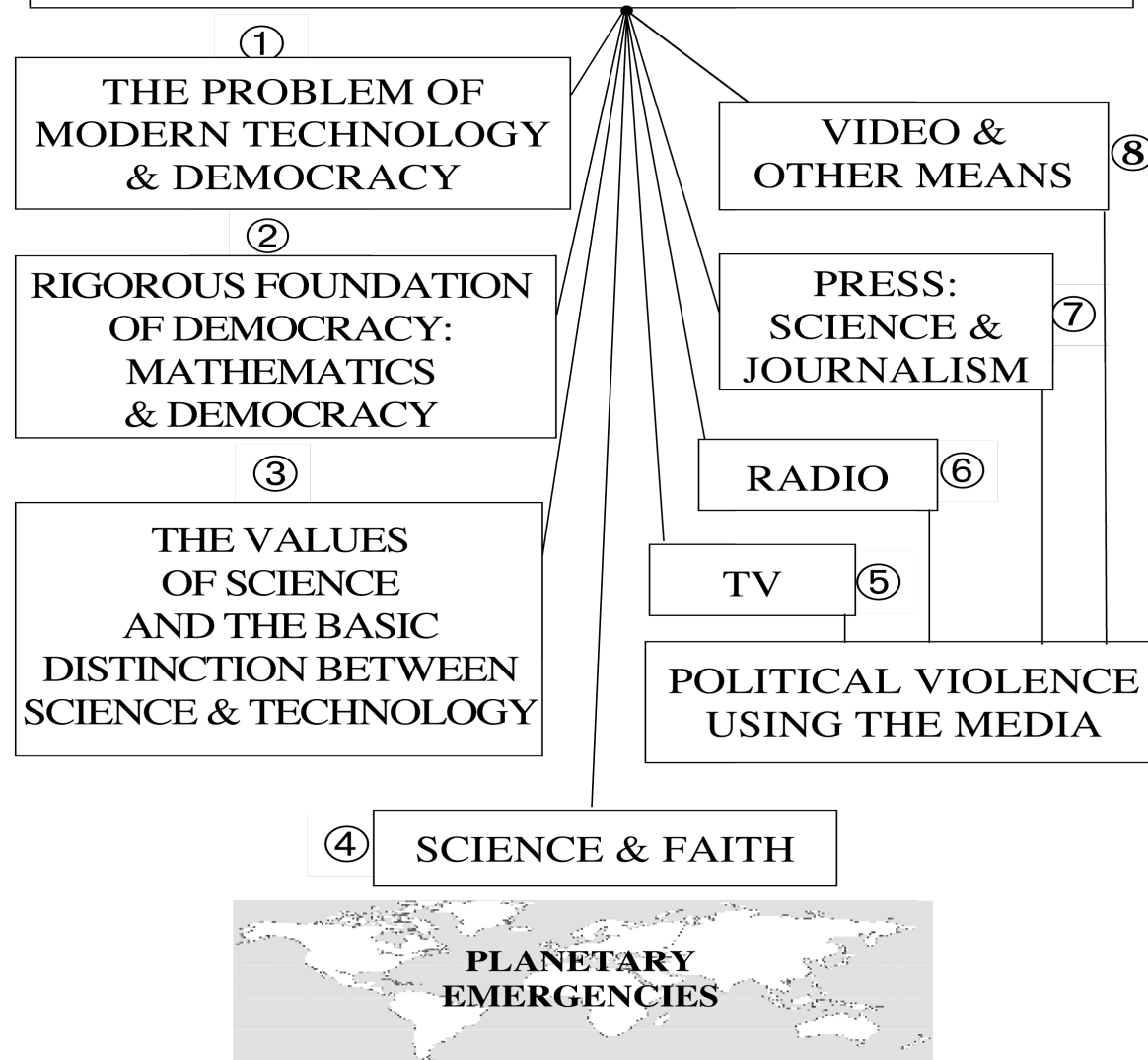
Total: 7



XIII

Total: 8

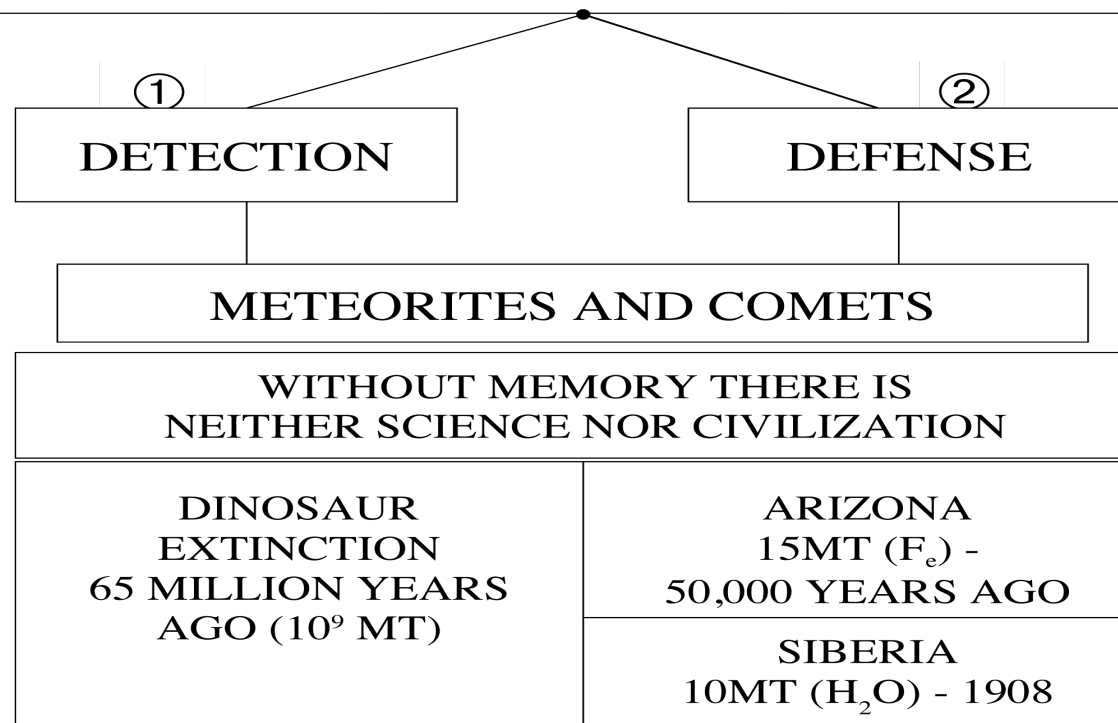
CULTURAL POLLUTION



XIV

Total: 2

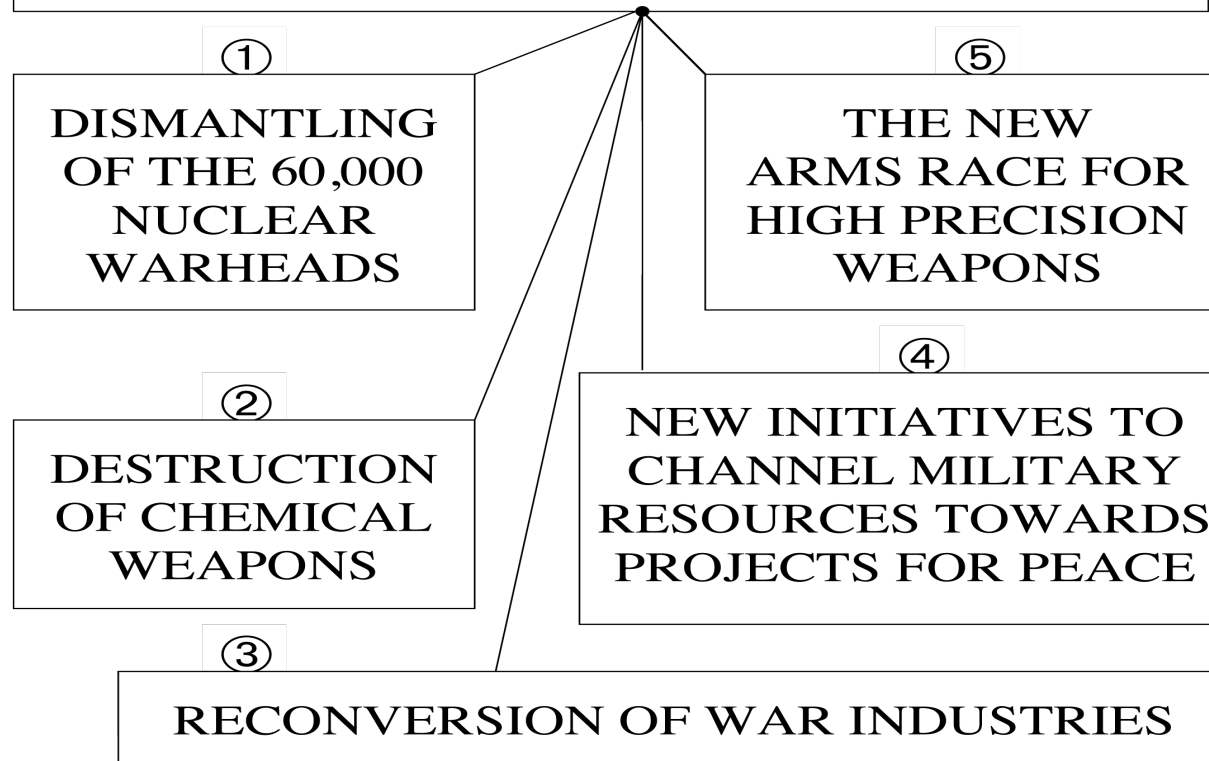
COMMON DEFENSE AGAINST COSMIC OBJECTS



XV

Total: 5

THE HUGE MILITARY INVESTMENTS



The results obtained with the implementation of 100 pilot projects – mostly in Developing Countries – allowed WFS to conclude that – if there is a political will – the Planetary Emergencies can be confronted and resolved.

To achieve this goal
it is essential that
the great public
be made aware of the priorities
which are necessary
to sustain
a great battle
for civilization.

Implicating the scientific community
of Fermilab and CERN
is of vital importance since
“A Project for Mankind”
must give absolute priority to
meritocracy and scientific excellence,
as taught by the
“Manhattan Project”.

Renormalization structure of the transition to chaos

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INFN, Sezione di Bologna - Italy

(ricevuto il 25 Gennaio 1996; approvato l'1 Marzo 1996)

Summary. — In this paper we establish, in parallel with QFT and statistical mechanics, a completely similar structure lying behind the study of transition of dynamical systems to chaos. We give the transformations T_m , which are a scale transformation supplemented by related changes of the parameters, in order to achieve invariance. Then we show that the T_m , obey the composition rule $T_m T_k = T_{m+k}$, $m \geq 0$. We thus find that a discrete semi-group structure exists, to exactly the same extent as it exists in statistical mechanics. The domain of validity is established like the UV domain of validity of QFT, or the long-range domain in statistical mechanics.

PACS 24.60.Lz – Chaos.

PACS 05.45 – Theory and models of chaotic systems.

1. – Introduction

One of the most interesting problems in the so-called Modern Theory of Chaos, is the study of the transition to chaos of dynamical systems. We have established that a structure similar to Quantum Field Theory (QFT) and statistical mechanics, exists for the transition to chaos of dynamical systems.

Before proceeding further, we would like to point out that the proof for the existence of chaos, in a rigorous sense, is still lacking.

A rigorous chaos would exist for example if a set of strongly coupled non-linear differential equations produced all sorts of results, in spite of the fact that the initial conditions are exactly the same.

Another possibility for the existence of chaos would be a finite system of axioms followed by rules. If the same system brought to different and contradictory conclusions, once again this would be the proof that chaos exists in a logical mathematical structure.

The so-called Modern Theory of Chaos depends on the lack of rigorous knowledge of some parameters in the initial condition and this has little to do with chaos.



Science has the certitude
of the Planetary Pollution.



Those who produce
Pollution
must be
severely punished.

★ **Science** cannot be accused
to be unable to write the equation,
as for example the
Newton equation,
in order to predict the
CLIMATE EVOLUTION.



The reason is following:

This equation cannot exist.

Only mathematical models
with very many free parameters.

Recall Von Neumann.