The Future of Our Science

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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

- **DINOSAURI** & **L’UOMO DI NEANDERTHAL**
  - **BB2**
  - **BB3**

- **The Whole of Our Knowledge**
  - **BB1**
  - **BB2**
  - **BB3**

- **RAGIONE**
  - **LINGUAGGIO**
    - Livello minimo di RAGIONE
  - **LOGICA**
    - Livello massimo Teorico di RAGIONE
  - **SCIENZA**
    - Livello massimo con VERIFICA SPERIMENTALE

- **Materia Inerte**
  - Stelle e Galassie

- **Materia Vivente**
  - dalla Pietra alla Rondine

- **Materia Vivente dotata di Ragione**
THE WHOLE OF OUR KNOWLEDGE AND THE THREE BIG BANGS

The Universe Now

10^{18} \text{ sec} \quad 10^{81} \text{ GeV}

10^{29} \text{ cm}

Universe Now

Planck Universe

62 Powers of Ten

in Space

in Time

in Energy

h_{\text{Universe}}

h_{\text{Planck}} \approx 10^{124}

Planck \Rightarrow c = h = G_N = 1

10^{-33} \text{ cm}; 10^{-44} \text{ sec}; 10^{19} \text{ GeV}

Life

with minimal level of REASON

Endowed with high level of REASON

Language

Logic

Science

L_a

L_0

S_1, 2, 3

SELF INTERACTION

Vegetal

Animal

Cogito ergo sum

Imagination becomes reality

Creativity

L_i

S_i

C_r

Li \equiv \text{Life} \quad Si \equiv \text{Self Interaction} \quad Cr \equiv \text{Creativity}

The Universe

Galaxies, Stars, Planets

The Superworld

43 Dimensions

Super (Space-Time)

Supersymmetry B \equiv F

Standard Model

3 Gauge Charges, Q_e, for 3 Fundamental Forces

12 Flavour Charges, Q_f, for 3 Columns

7 Basic Quantities

c \neq \infty \equiv \text{Fundamental Constant} \quad h \neq 0 \equiv \text{Fundamental Constant}
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
Please read the Chapter XII of my book
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
THE FUTURE OF OUR CIVILIZATION HAS ITS ROOTS IN OUR LABS
A PROJECT FOR MANKIND
SCIENCE FOR PEACE THE WORLD OVER:
THE NEW MANHATTAN PROJECT

THE LOGICAL STRUCTURE OF THE PROJECT

SCIENTIFIC-TECHNICAL-CULTURAL
PROGRESS

Science

Galilean Frontiers
ELN

Complexity and Simplicity

Technology

LAA μ-electronics

ΔX, ΔE, Δt, ΔM, ΔQ

ToF

Biotechnology

AMS

Parallel Processors
Supercomputer

Planetary Emergencies
Pilot-Projects

Medical

Computing

Culture

Science in School

Defeat Cultural Hiroshima

Science endeared to the Public

Housing for the Poor

Solidarity

Fight Usury

ELECT AN
ad hoc Commission

Reduce the number of Laws
and increase clarity in the formulation

Direct Democracy

Modern Technology is creating
a challenge to the motivations for
democratic representation:
impossible for all to be
in the same place

Which mathematical system
better corresponds to
the needs of democracy

Mathematics and Democracy

ENCLOSURES:

1 ELN (300 KM; 10^6 GeV = 10^3 TeV = 1 PeV)
2 LAA (New Technologies for Space, Time, Energy and Mass)
3 EEE (Extreme Energy Events – Science in Schools)
4 Planetary Emergencies (Pilot-Projects)
5 The Logical Roots of Complexity
THE NEW
MANHATTAN PROJECT
Science for Peace the World Over

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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.
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<th>THE 72 PLANETARY EMERGENCIES</th>
<th>NUMBER OF SOURCES</th>
</tr>
</thead>
<tbody>
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<td>I WATER</td>
<td>4</td>
</tr>
<tr>
<td>II SOIL</td>
<td>3</td>
</tr>
<tr>
<td>III FOOD</td>
<td>5</td>
</tr>
<tr>
<td>IV ENERGY</td>
<td>5</td>
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<td>V POLLUTION</td>
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<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>72</strong></td>
</tr>
</tbody>
</table>
I

Total: 4

WATER

1. PROTECTION OF NATURAL RESOURCES

2. SEARCH FOR NEW SOURCES

3. DESALINIZATION

4. SAVINGS

PLANETARY EMERGENCIES
SOIL

1. PROTECTION AGAINST POLLUTANTS
2. DEFENCE FROM CATASTROPHIC EVENTS
3. DROUGHT AND DESERTIFICATION
III

Total: 5

FOOD

- PRODUCTION
- CLASSICAL AGRICULTURE
- MARINE AGRICULTURE
- PROCESSING
- STORAGE
- NEEDS & WASTE

PLANETARY EMERGENCIES
A. ZICHICHI – The Future of our Science – ISSP – 17 June 2017

IV  Total: 5

ENERGY

PRODUCTION

CHEMICAL

NUCLEAR

FUSION
(Future)

FISSION
(Now) Waste Transformation
Accelerator Driven
Reactors (I.S.)*

*I.S. = Intrinsically Safe

INCREASED EFFICIENCY & SAVINGS

DISTRIBUTION

RENEWABLE

PLANETARY EMERGENCIES
V
Total: 7

POLLUTION

GLOBAL

① THE CO2 PROBLEM

② GREENHOUSE EFFECT

③ OZONE DEPLETION

④ ACID RAIN

LOCAL

⑦ INDUSTRY

⑥ URBAN AND DOMESTIC

⑤ OIL AND CHEMICAL SPILLS

PLANETARY EMERGENCIES
LIMITS OF DEVELOPMENT

1. DEMOGRAPHIC GROWTH
2. THE MEGA METROPOLISES AND THE COLLAPSE OF ALL VALUES
3. WATER, SOIL, FOOD, ENERGY
4. UNEMPLOYMENT
VII

CLIMATIC CHANGES

1. The Mathematics Needed to Simulate the Meteorological Motor

2. The Experimental Data Needed in Order to Check the Validity of the Predictions

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

Planetary Emergencies
GLOBAL MONITORING OF THE PLANET

1. POLLUTION MONITORING
2. ATMOSPHERIC MONITORING
3. DEFENCE AGAINST FLOODS AND OTHER UNEXPECTED EXTREME EVENTS
4. EARTHQUAKES
5. VOLCANOES & CALDERA
6. DEFENCE AGAINST COSMIC OBJECTS
NEW MILITARY THREATS IN THE MULTIPOLAR WORLD

1. GLOBAL DEFENCE SYSTEM
2. DANGER OF PROLIFERATION OF WMD*
3. TERRORISM

*WMD = Weapons of Mass Destruction
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

PLANETARY EMERGENCIES
THE PROBLEM OF ORGAN SUBSTITUTION

1. ARTIFICIAL ORGANS
2. NATURAL ORGANS
3. THE UNDERSTANDING OF "MINIMAL LIFE"
4. FROM INERT TO LIVING MATTER
5. THE CONTRIBUTION COMING FROM GENETIC ENGINEERING

PLANETARY EMERGENCIES
MEDICINE, INFECTIOUS AND OTHER DISEASES

1. AIDS
2. OTHER PATHOLOGIES (Ebola*)
3. INFECTIONS DUE TO STANDARD MEDICAL CARE
4. IN THE FIELD (Ebola*)
5. NEUROPATHOLOGICAL SOURCES
6. BIOTECHNOLOGICAL SOURCES
7. IN THE LABORATORY (Ebola*)

TOTAL: 7
CULTURAL POLLUTION

1. THE PROBLEM OF MODERN TECHNOLOGY & DEMOCRACY

2. RIGOROUS FOUNDATION OF DEMOCRACY: MATHEMATICS & DEMOCRACY

3. THE VALUES OF SCIENCE AND THE BASIC DISTINCTION BETWEEN SCIENCE & TECHNOLOGY

4. SCIENCE & FAITH

5. TV

6. RADIO

7. PRESS: SCIENCE & JOURNALISM

8. VIDEO & OTHER MEANS

PLANETARY EMERGENCIES
COMMON DEFENSE AGAINST COSMIC OBJECTS

1. DETECTION
2. DEFENSE

METEORITES AND COMETS

WITHOUT MEMORY THERE IS NEITHER SCIENCE NOR CIVILIZATION

- DINOSAUR EXTINCTION 65 MILLION YEARS AGO (10^9 MT)
- ARIZONA 15MT (Fe) - 50,000 YEARS AGO
- SIBERIA 10MT (H_2O) - 1908

PLANETARY EMERGENCIES
THE HUGE MILITARY INVESTMENTS

1. Dismantling of the 60,000 nuclear warheads
2. Destruction of chemical weapons
3. Reconversion of war industries
4. New initiatives to channel military resources towards projects for peace
5. The new arms race for high precision weapons

Total: 5
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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(ricevuto il 25 Gennaio 1996; approvato l'11 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 $T_mT_k = T_{m+k}$, $m \geq 0$. 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.