

ANTONINO ZICHICHI – 7 NOVEMBER 2019

International Symposium on “Passion for Science – New Elements and New Materials”
on the occasion of the International Year of the Periodic Table of Chemical Elements IYPT2019

ELEMENTS and ANTI-ELEMENTS

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7 November 2019, h.14:30

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THE WHOLE OF OUR KNOWLEDGE, THE THREE BIG BANGS AND THE SUPERWORLD

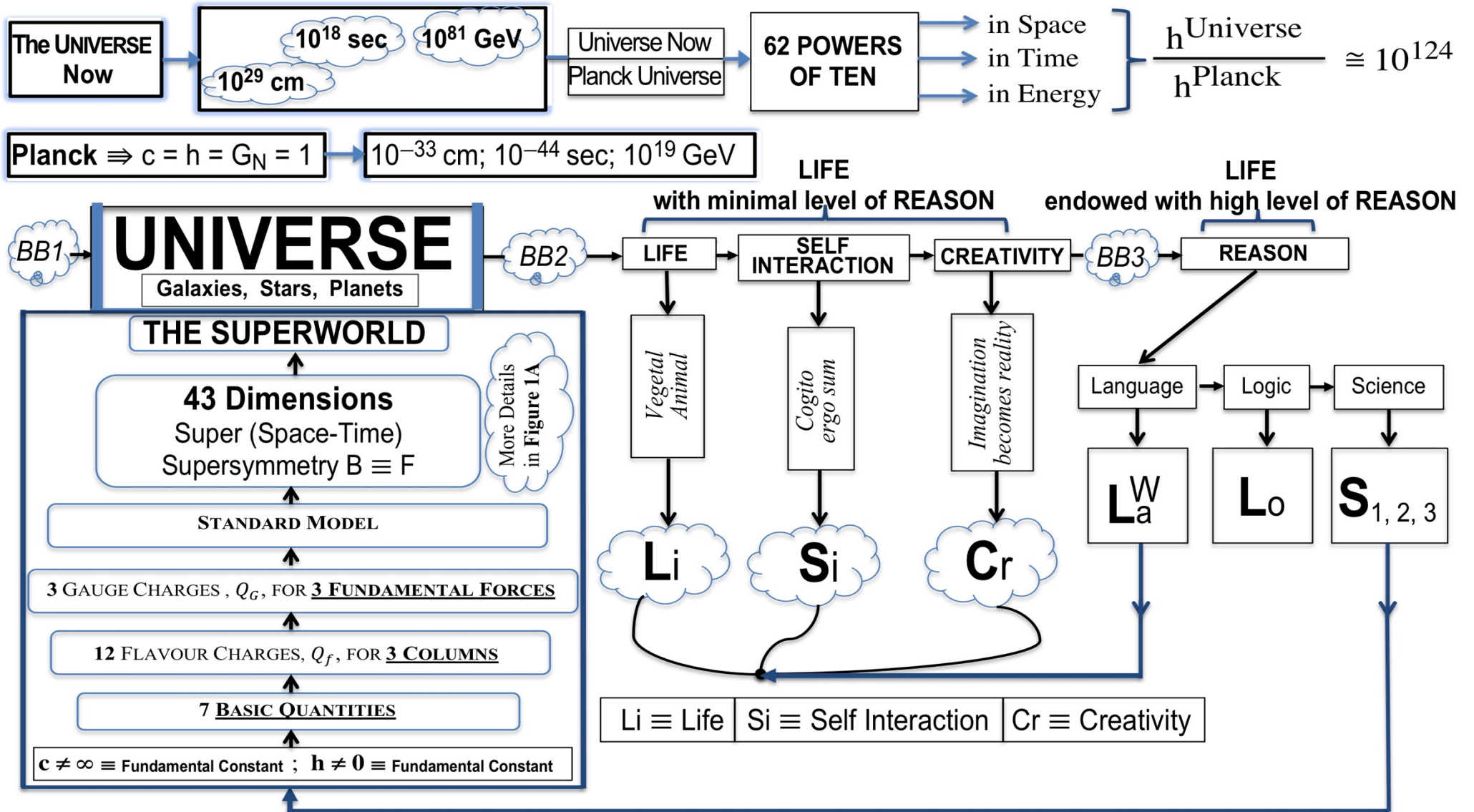


Figure 1

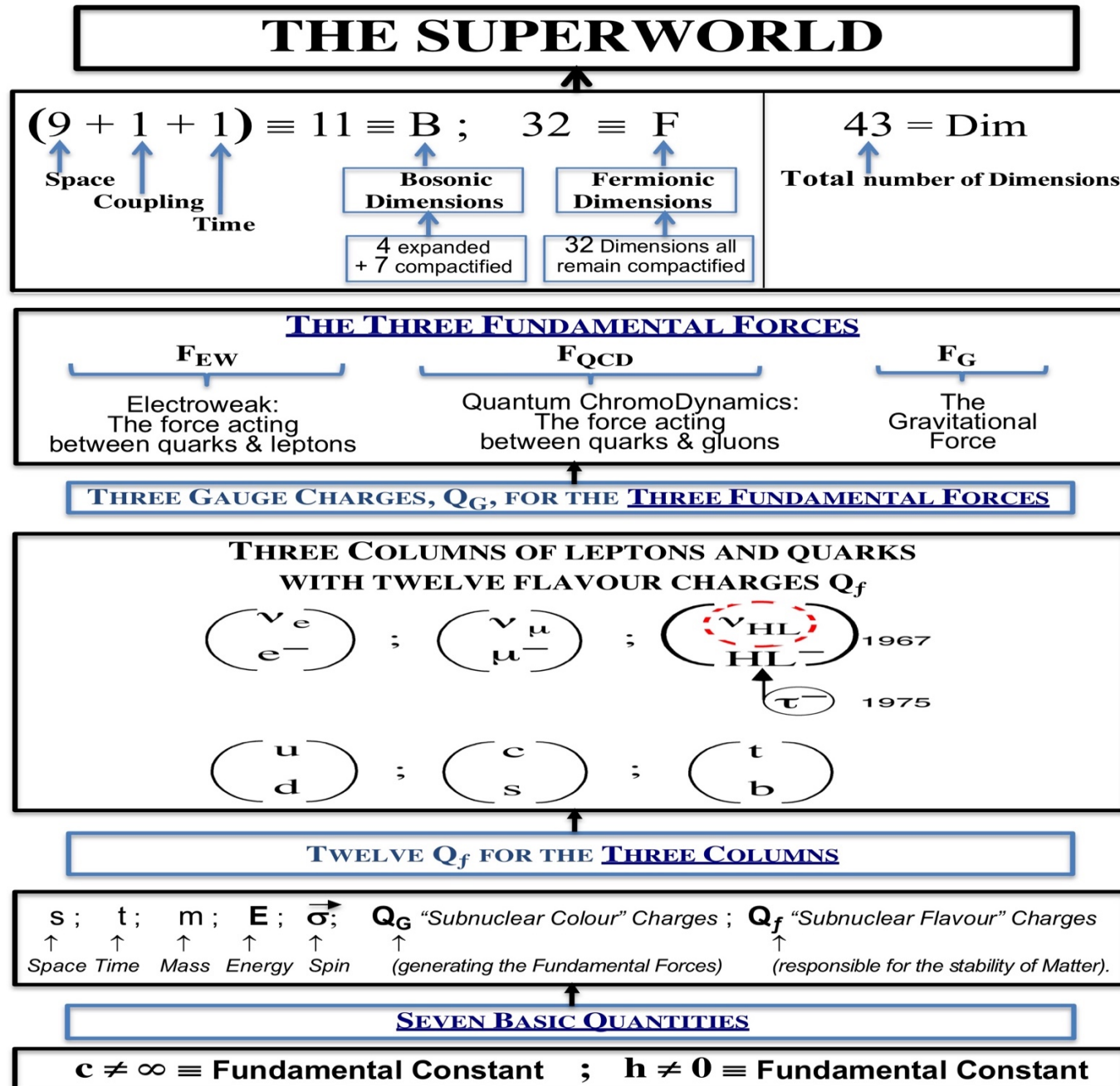


Figure 1A

THE UNIFICATION OF ALL FUNDAMENTAL FORCES AND THE EGM EFFECT

The three lines (α_1^{-1} , α_2^{-1} , α_3^{-1}) in **Figure 4** result from calculations executed with a supercomputer using the following system of equations:

$$\mu \frac{d\alpha_i}{d\mu} = \frac{b_i}{2\pi} \alpha_i^2 + \sum_j \frac{b_{ij}}{8\pi^2} \alpha_i \alpha_j$$

α_i , α_j (with $i = 1, 2, 3$; and $j = 1, 2, 3$ but $i \neq j$).

This is a system of coupled non-linear differential equations which is valid to mathematically describe an experiment where three quantities play a fundamental role. In our case the three fundamental quantities are the gauge couplings (α_1 , α_2 , α_3) which vary with “ μ ”, the basic parameter which depends on the energy of the elementary process, from the maximum level of Energy (Planck Scale) to the energy level of our world (NOW). **During more than ten years (from 1979 to 1991), no one had realized that the energy threshold for the existence of the Superworld was strongly dependent on the “running” of the masses.**

This is now called: **the EGM effect** (from the initials of Evolution of Gaugino Masses). This effect produces a factor 700 in the threshold for the lightest supersymmetric particle. No one knows the value of the threshold Energy for the production of the lightest supersymmetric particle. The EGM effect lowers this value by a factor 700. Suppose that somebody would say that the **threshold is at 700 TeV; thanks to the EGM effect** this value is going to be **1 TeV**. In **Figure 5** the details in the high energy range indicate the existence of a GAP between $E_{GUT} - E_{Planck}$. The GAP is the first evidence for the origin of the three Forces [QED (α_1) + QFD (α_2) + QCD (α_3)] being at E_{GUT} (the energy of the Grand Unified Theory) many orders of magnitude below E_{Planck} . This GAP suggests that the gravitational forces are generated before the other three Forces (QED, QFD, QCD).

Figure 2

INVERSE GAUGE COUPLINGS
 α_i^{-1} [$i = 1(QED); 2(QFD); 3(QCD)$]

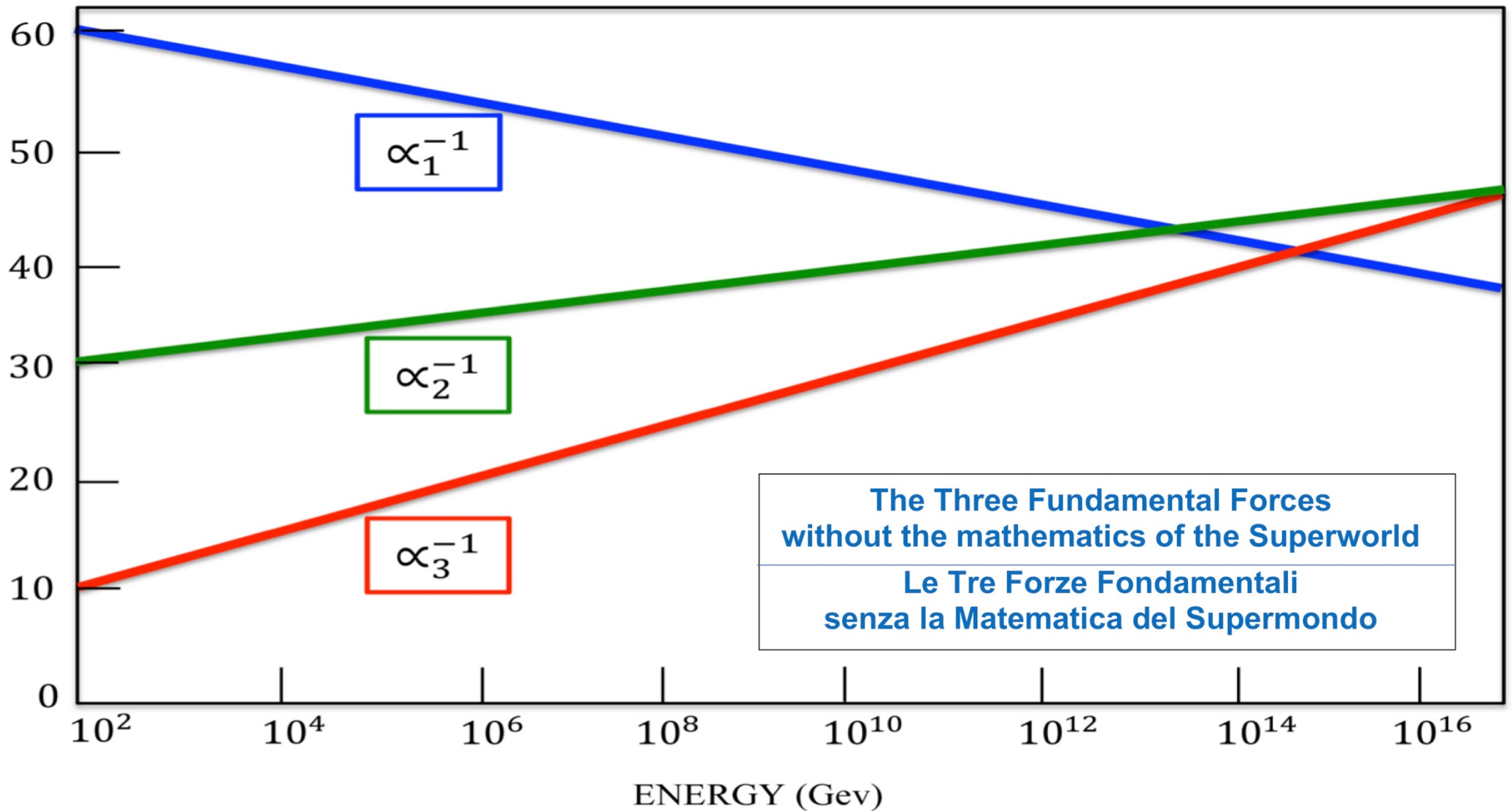


Figure 3

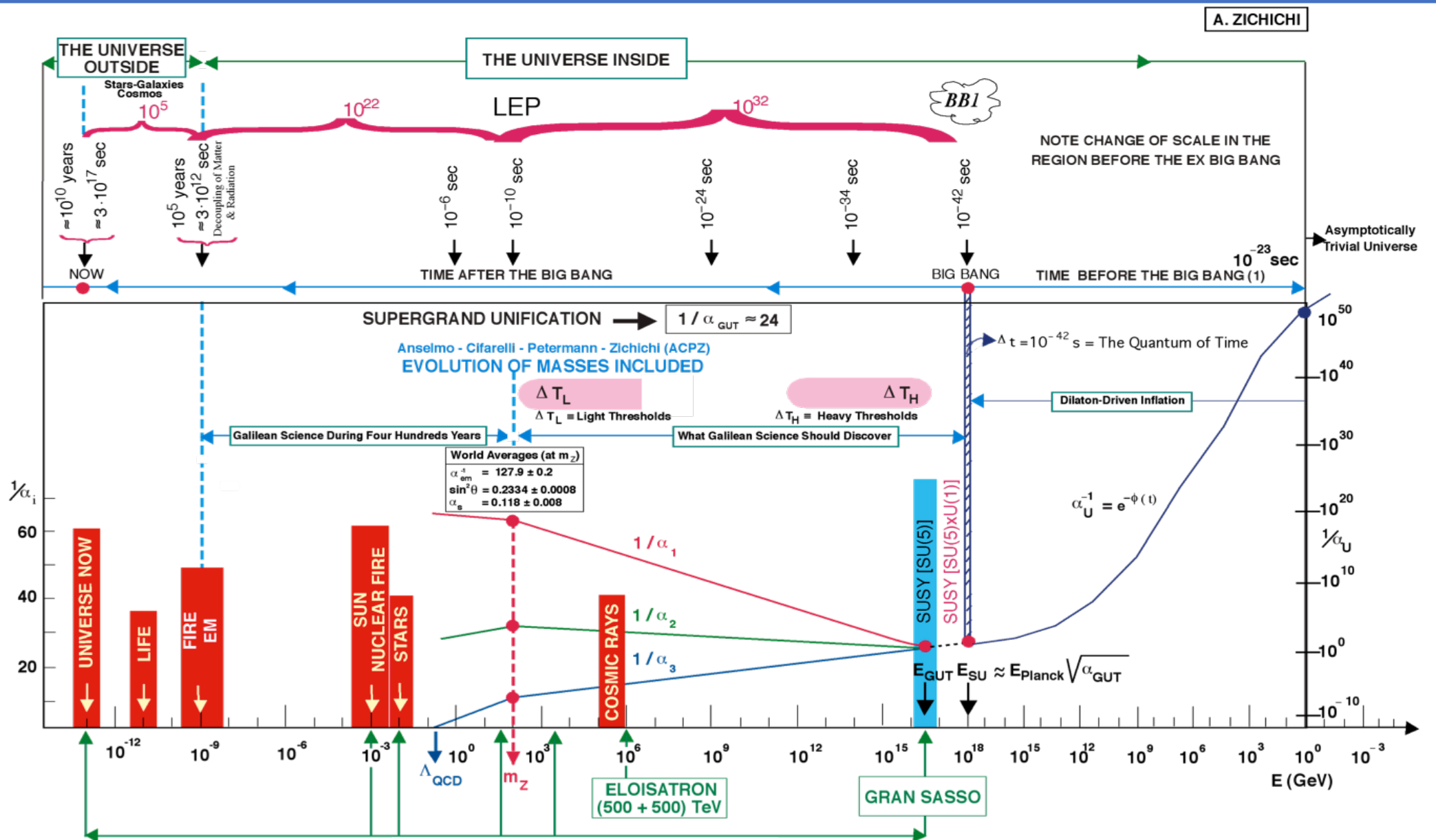


Figure 4: The present status of the unification of the three gauge couplings $\alpha_1 \alpha_2 \alpha_3$ is reported. This is the most accurate description of the unification whose mathematics is in **Figure 2**.

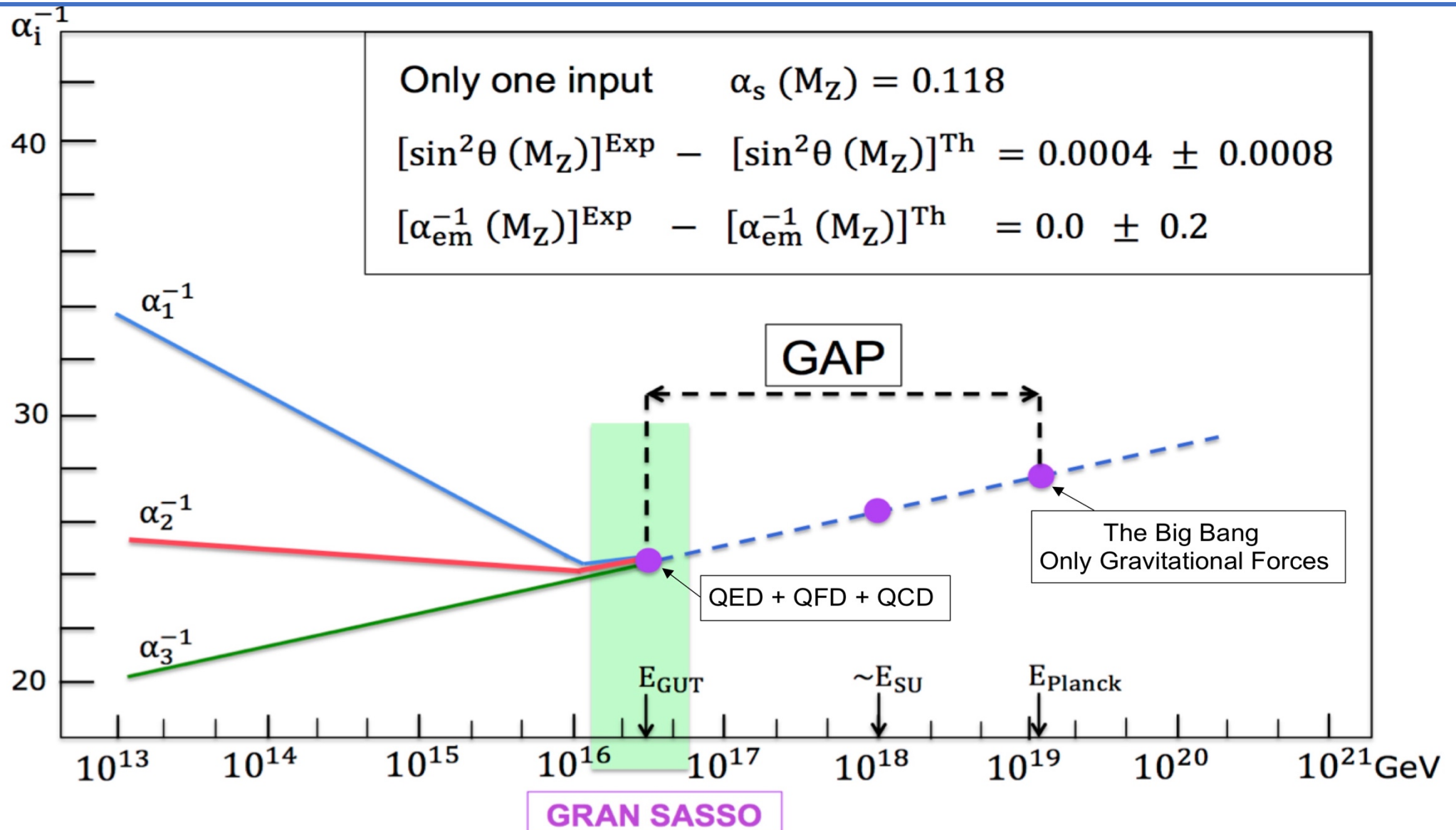


Figure 5: The GAP between the Planck Energy, E_{Planck} , and the two energy levels, E_{GUT} , where the three gauge couplings converge and E_{SU} , the energy where the RQST (Relativistic Quantum String Theory) puts the origin of the Gravitational Forces. The Gran Sasso is the biggest underground Lab to study neutrinos and cosmic energies of extremely high values.

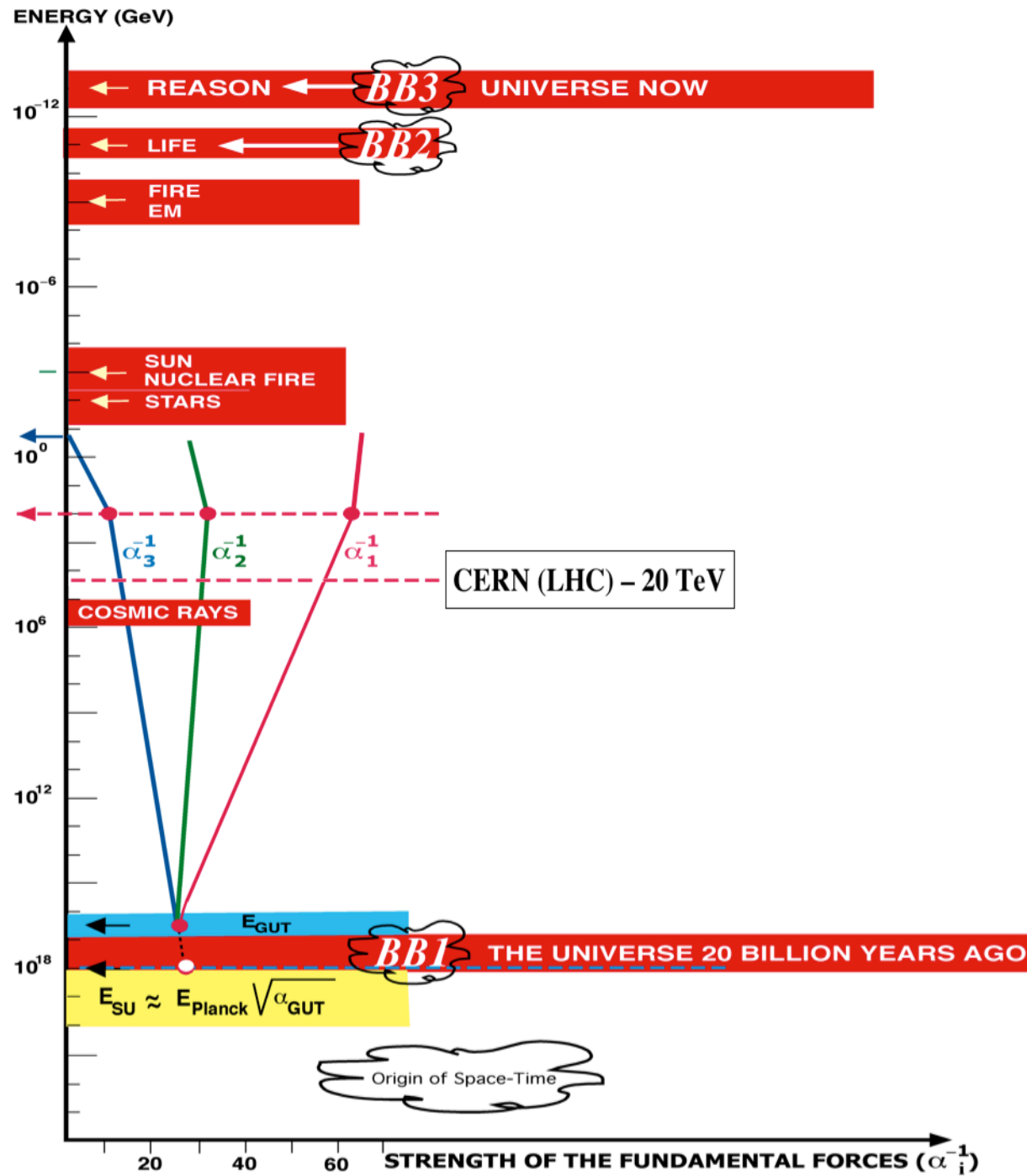


Figure 6

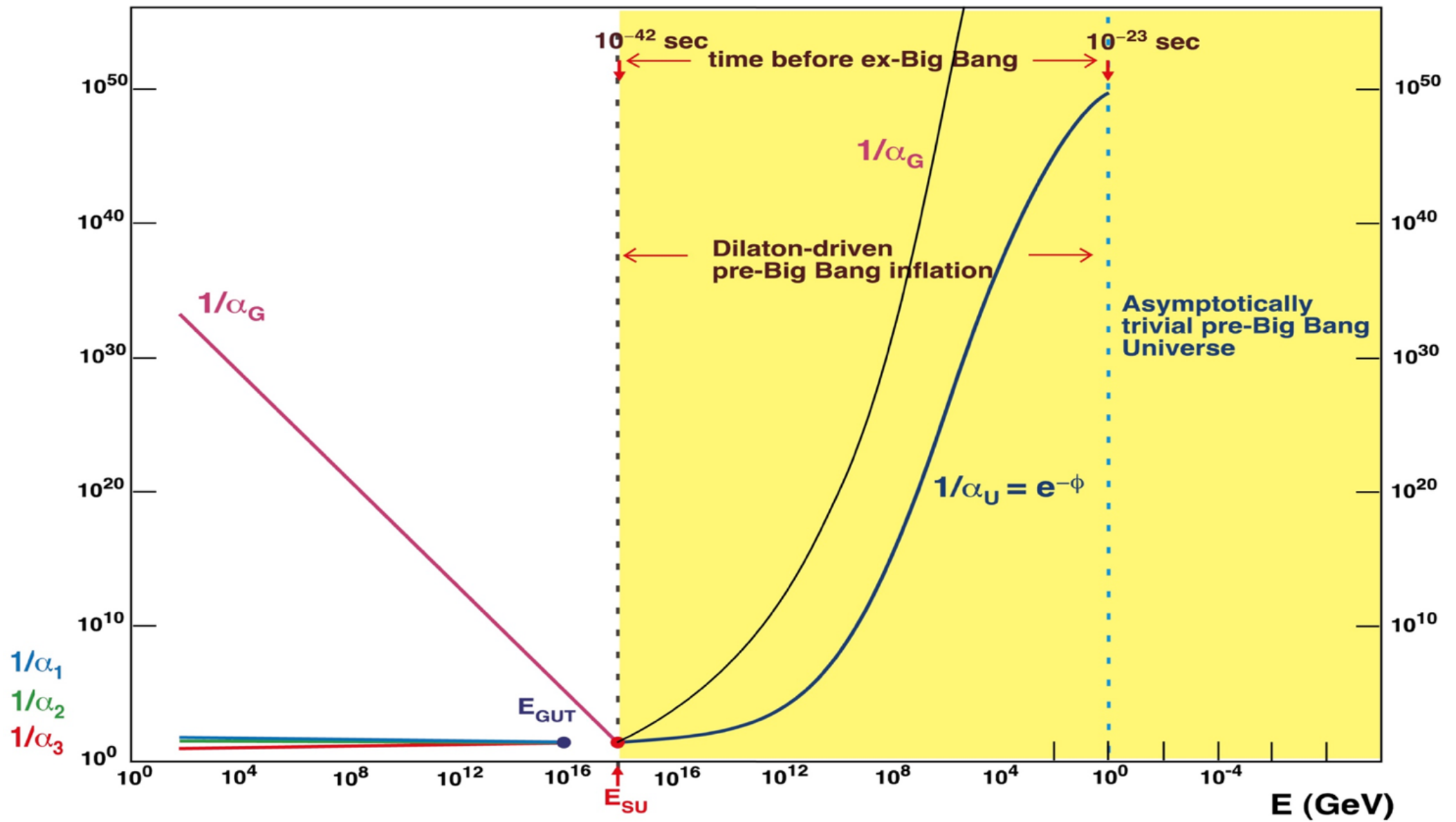


Figure 7

November 1976 – WASHINGTON

BB1

FROM VACUUM TO THE UNIVERSE
WITH INERT MATTER

SUPERWORLD

11 Bosonic Dimensions, 32 Fermionic Dimensions = (43)

BB2

FROM INERT MATTER
TO MATTER WITH LIFE

Zichichi c'è l'ha con Darwin $\Rightarrow 10^2 \div 10^3$

Many secret Labs

**The Problem
of Minimal Life**

BB3

FROM MATTER WITH MINIMUM LEVEL OF REASON (NEEDED FOR LIFE)
TO MATTER WITH THE HIGHEST LEVEL OF REASON \Rightarrow **REASON**

The Meaning of Big Bang

Phase Transition

(examples: Ice, Water, Vapour)

Language (*Written Language* = permanent collective memory),
Rigorous Theoretical Logic (*Mathematics*) and
Rigorous Experimental Logic (*Science*).

This extremely successful name given to the Schwarzschild solution of the Einstein equation produced the effect of neglecting the fundamental meaning of the Schwarzschild formula which establishes between the radius of the horizon (R^{PM}) of a point-like massive (PM) object and its mass (M^{PM}) a very important coupling:

$$R^{\text{PM}} = \frac{2G M^{\text{PM}}}{c^2} \cong 1.5 \cdot 10^{-28} \cdot \text{cm} \cdot \text{g}^{-1} \cdot M^{\text{PM}} \quad (1)$$

The Universe Density must decrease with M^{-2} .

The Mass and the Vacuum of our Universe

We would like to understand the origin of the mass and of the vacua of our Universe on the basis of the Planck fundamental constants and the Schwarzschild solution of the Einstein equation.

The fact that the Schwarzschild equation [1] allows to get the value for the mass and the vacua of our Universe **when**, starting from the Planck Universe, its radius increases by 62 powers of ten, cannot be a casual coincidence, but the result coming from the Evolution of the Universe.

We know that the structure of our Universe has the Galaxies concentrated along lines and planes immersed in very large amount of empty spaces.

The first of these empty spaces was discovered in 1981 in the Boöte constellation. It is estimated that about 98% of the Universe volume is empty.

The reason why these empty spaces must exist is the consequences of its evolution.

We find that the evolution is described by the Schwarzschild equation [1] which predicts that the density of the Universe must decrease with the square of its mass.

The evolution of the Universe is illustrated in Figures 8 and 9 whose origin is in the intellectual venture whose author is Max Planck [2].

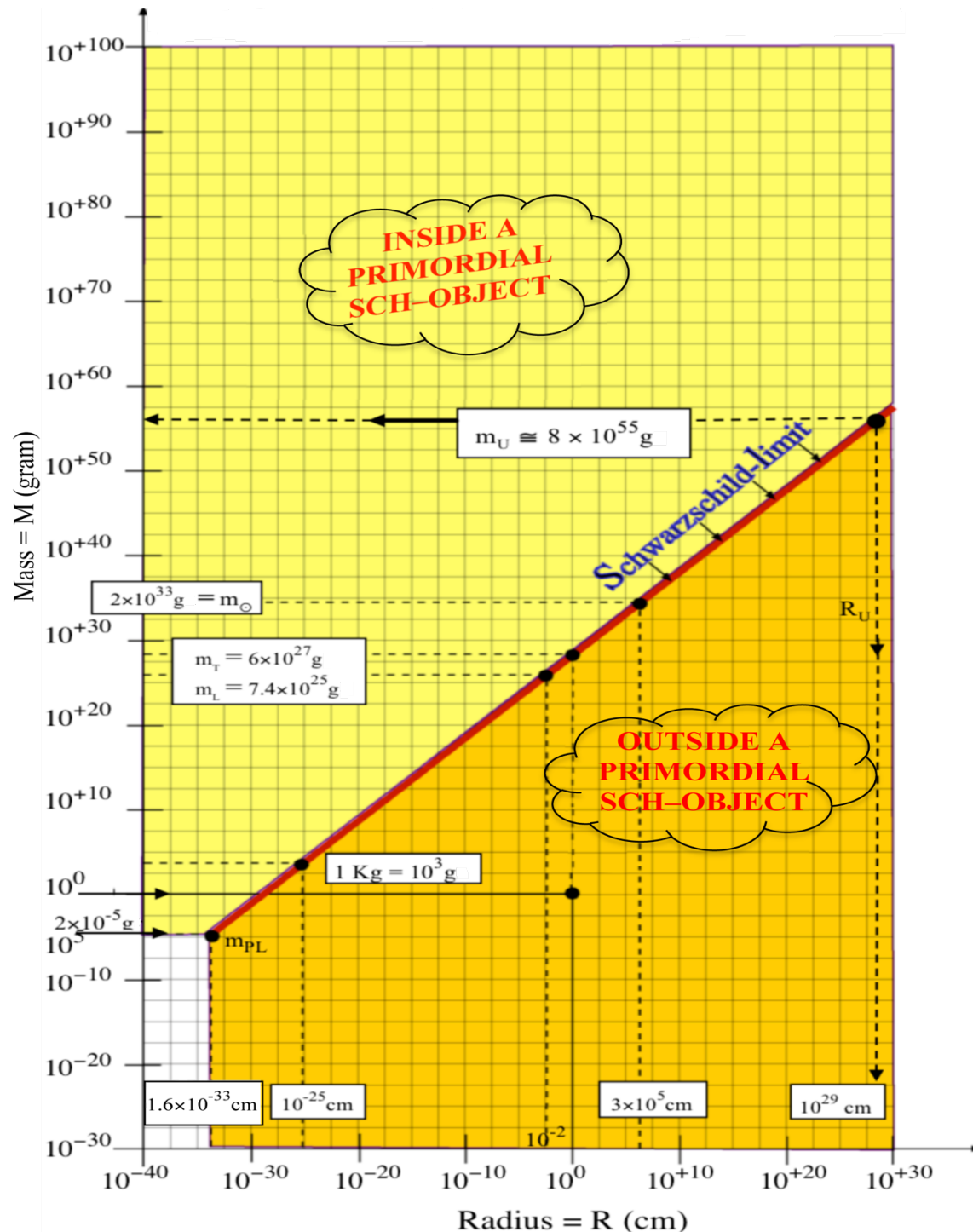


Figure 8: The Schwarzschild law between the radius of the gravitational horizon and the mass from the smallest to the largest SCH-object.

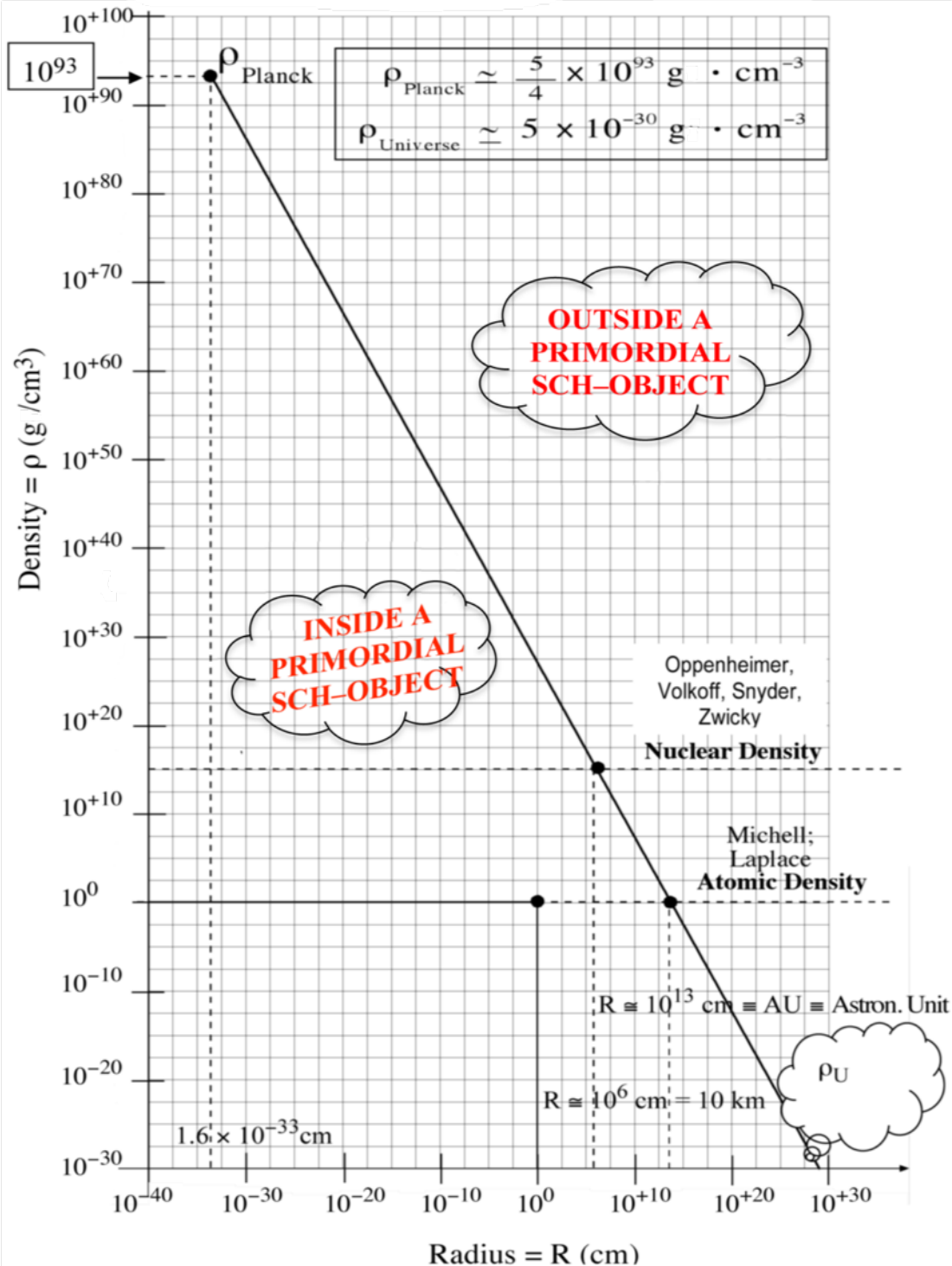


Figure 9: The relation which exists between the value of the SCH radius (R_{SCH}) and the corresponding density (ρ_{SCH}), from the smallest (the Planck Universe) to the largest SCH-object (the Universe now).

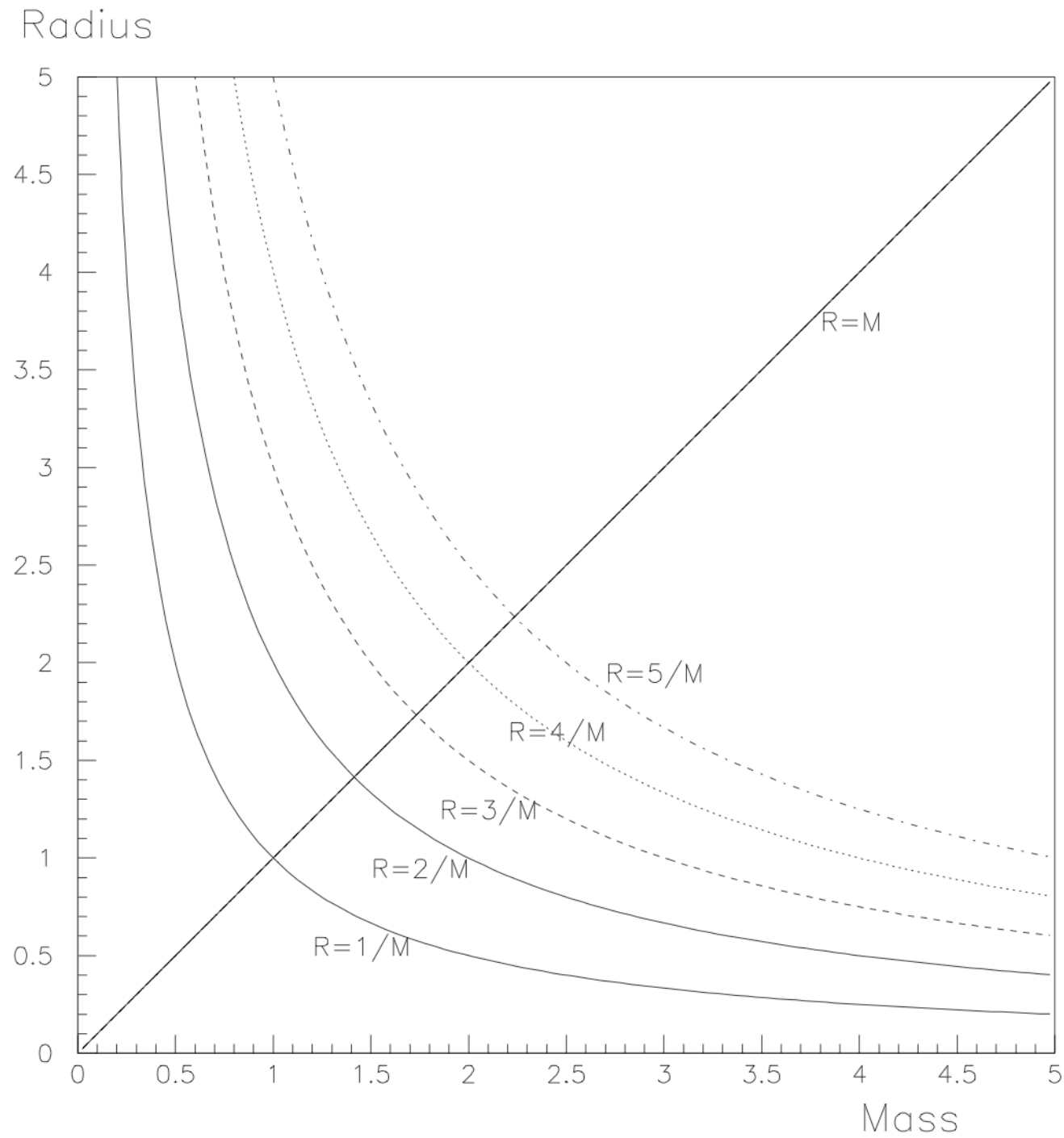


Figure 10

The Evolution of the Universe:
from the Planck Universe
to our Universe Now
with its Mass (Figure 8)
and Density (Figure 9).

Nessuno sa spiegare né la Massa né la
Densità dell'Universo.

C'è una sola possibile risposta:
Schwarzschild solutions
of Einstein Equation.

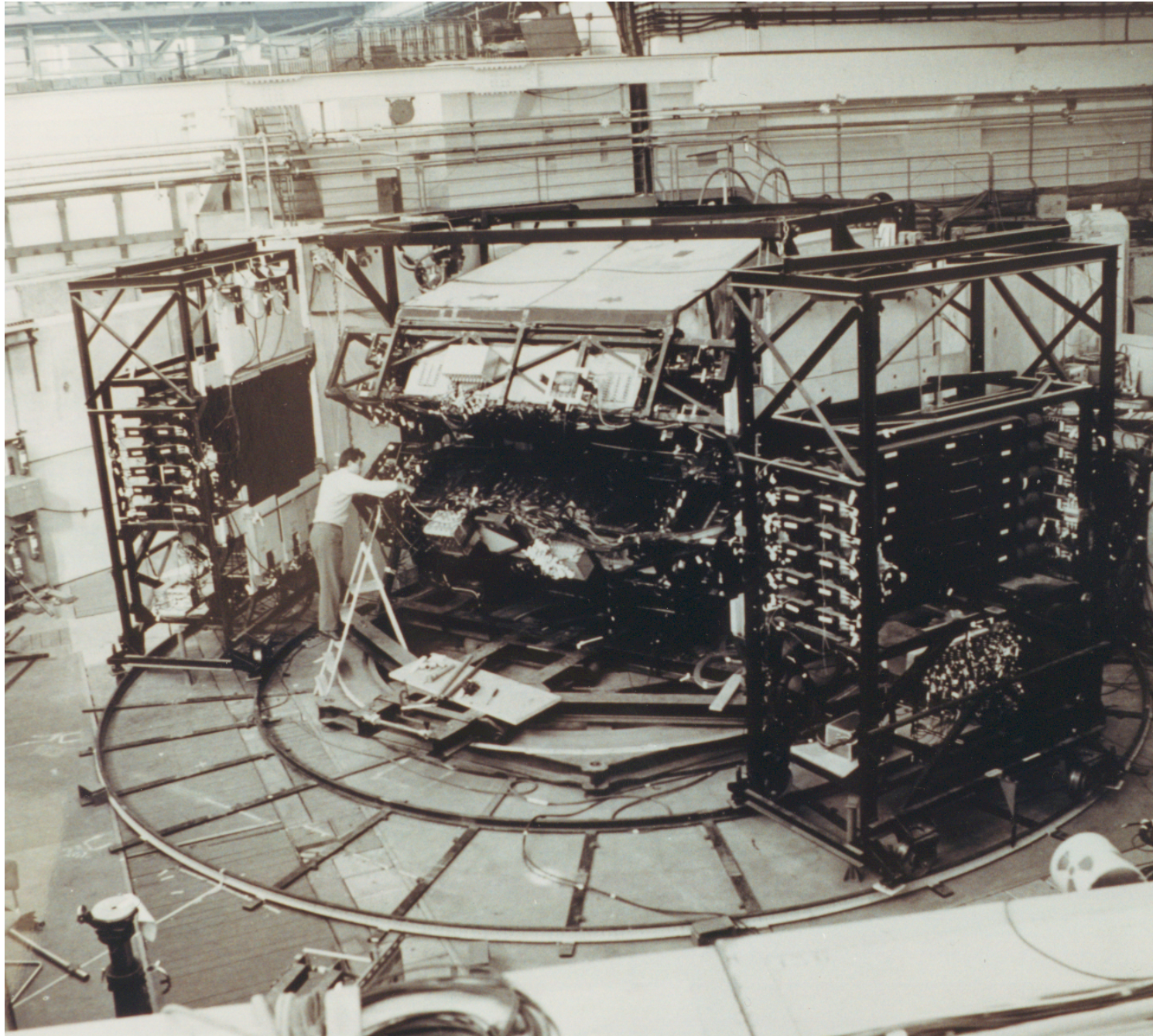


Figure 11

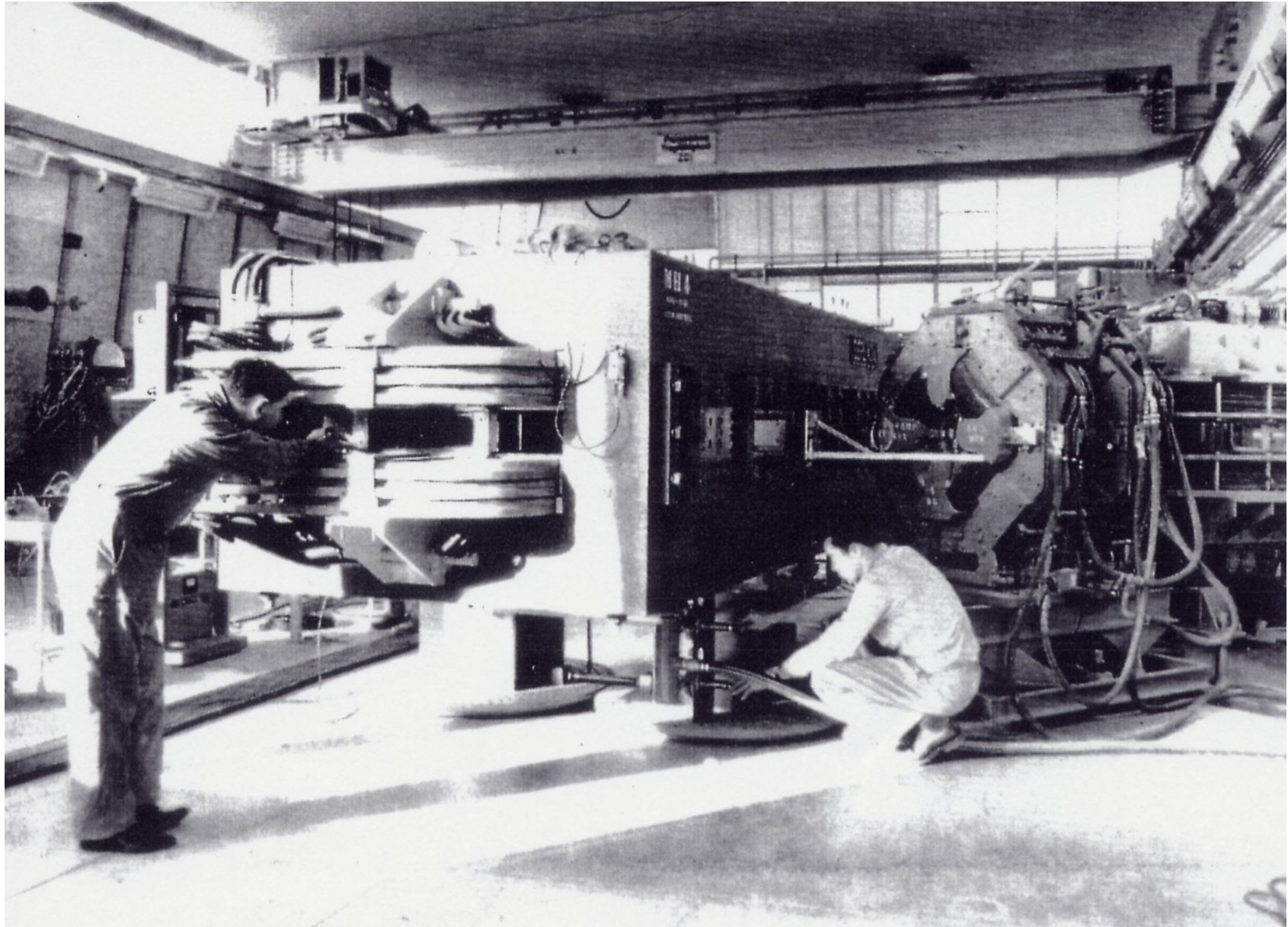


Figure 12

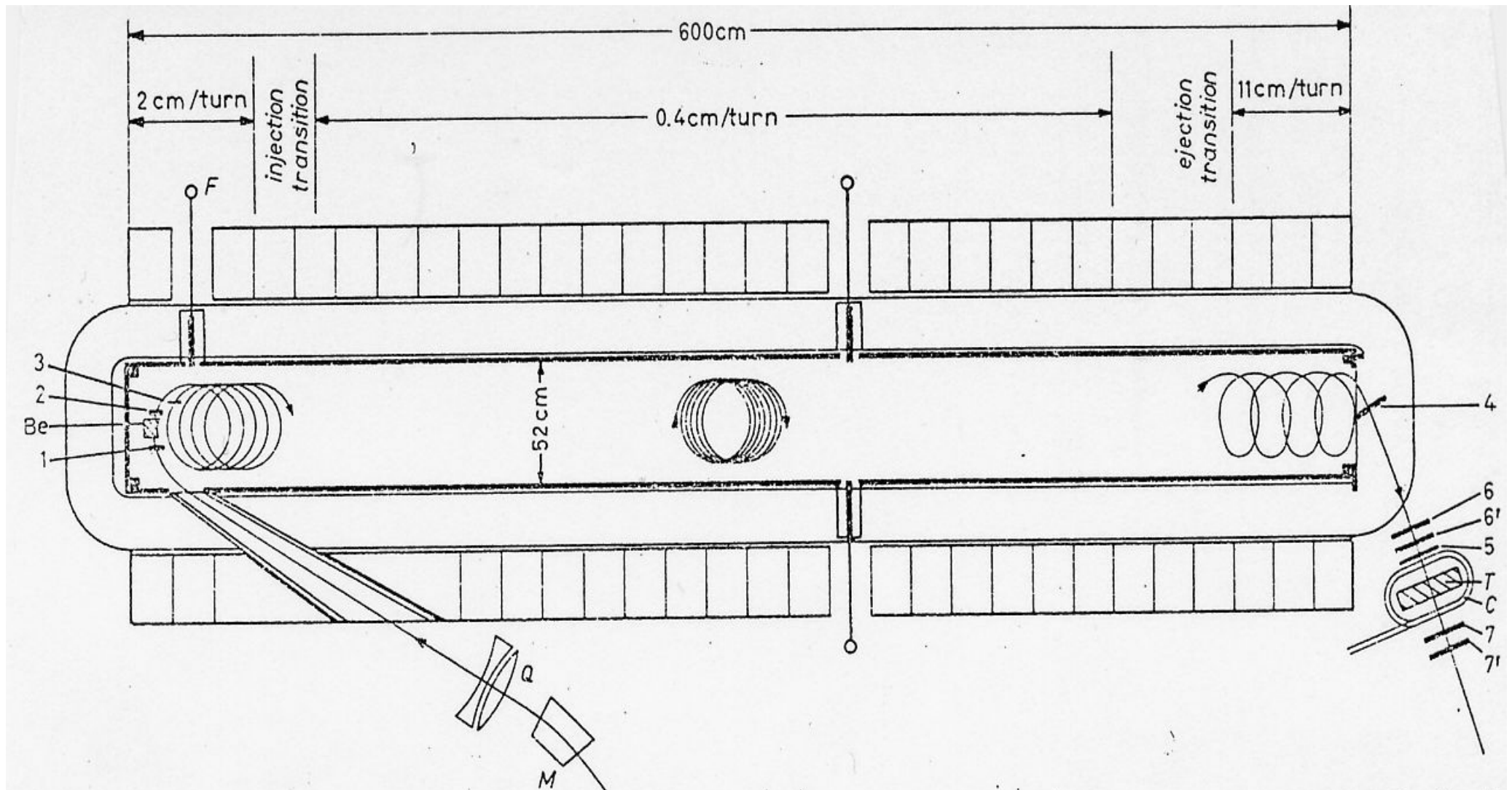


Figure 13

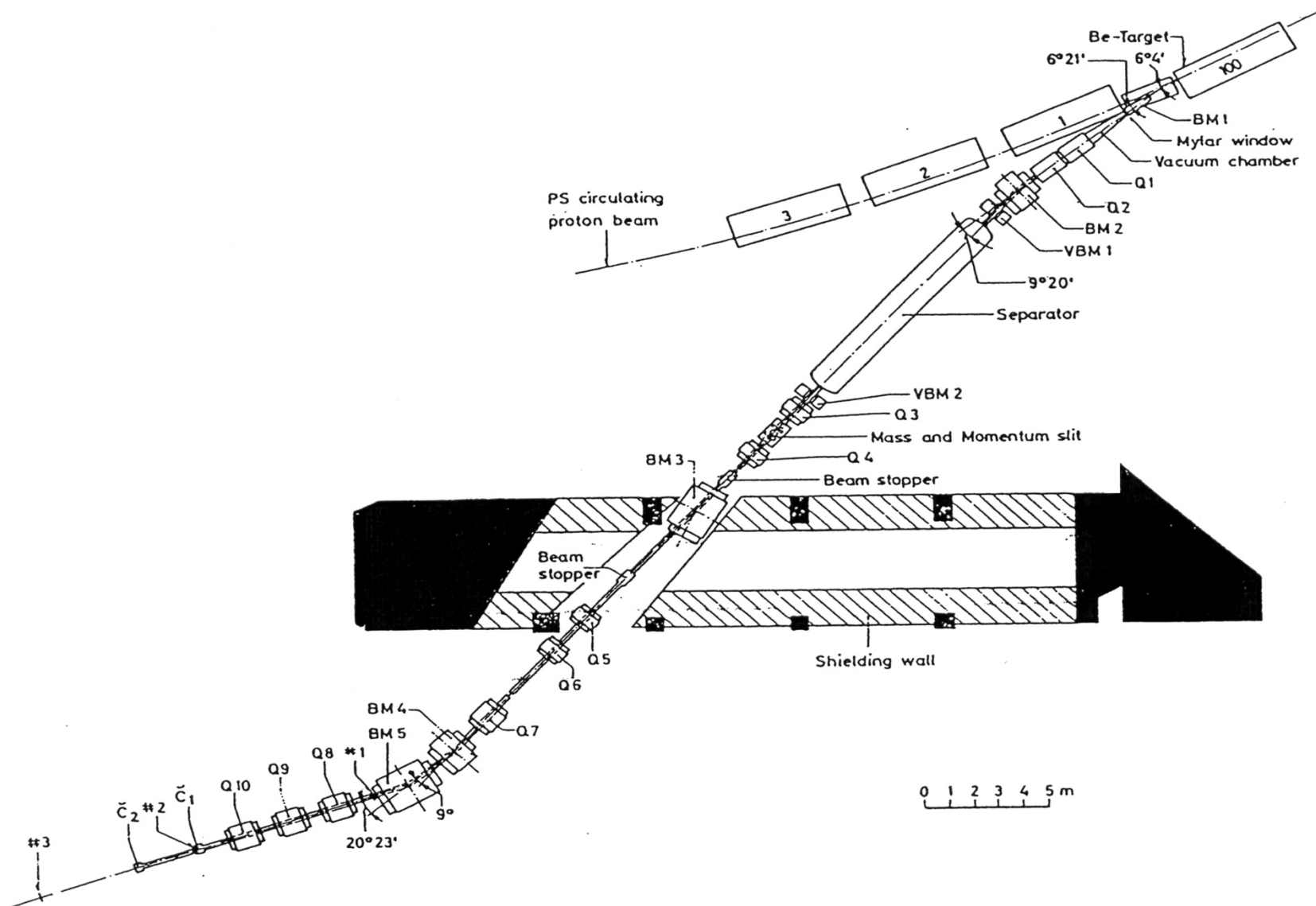


Figure 14

Jet engines outside the structure of the airplane



Jet engines inside the structure of the airplane

Figure 15 – Freehand sketch by the author to illustrate the positioning of jet engines in an airplane.

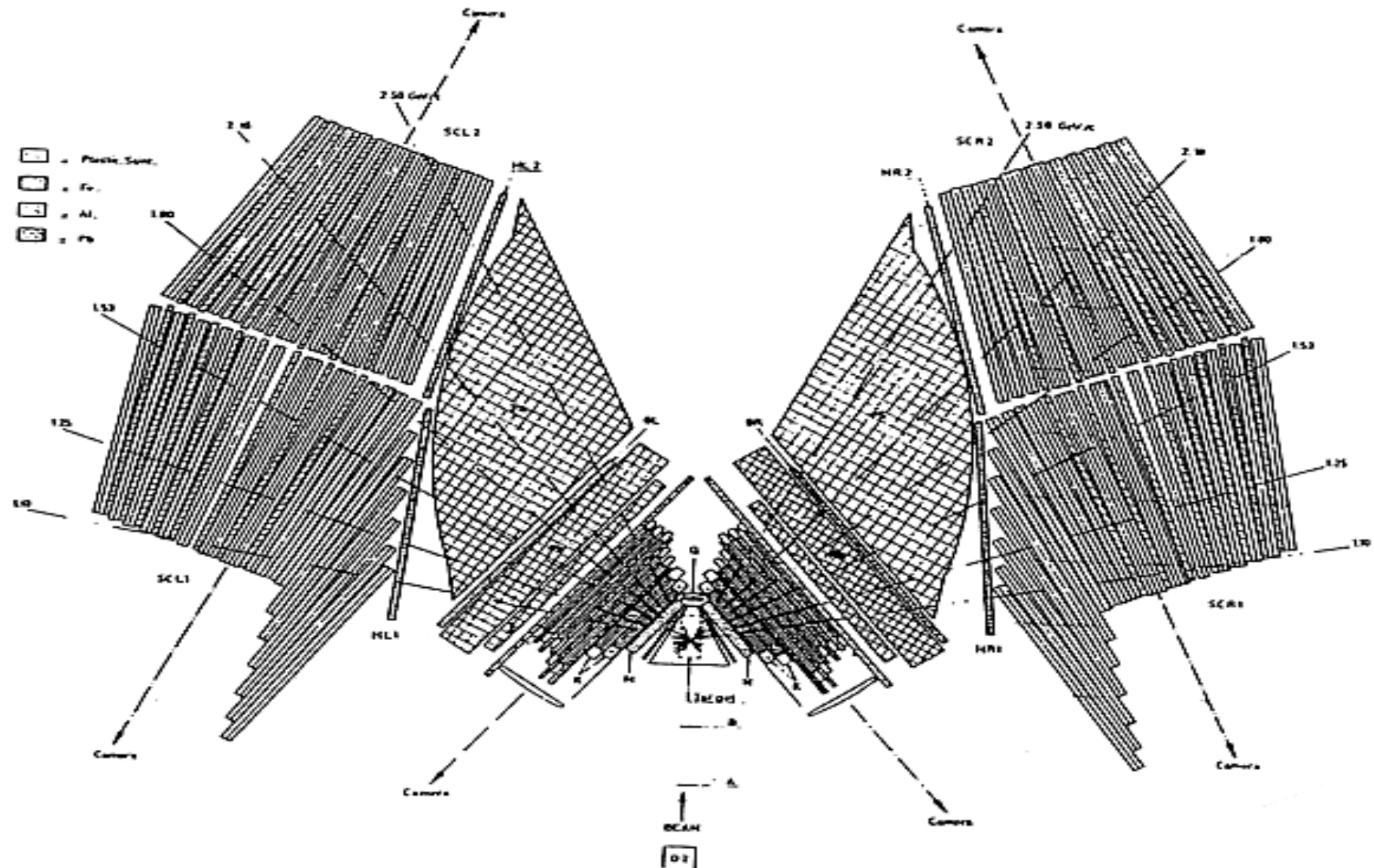


Figure 16