

# A History of the Universe since the Year Dot The Unfinished Drama of Planet Earth

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[THE HOUSE LIGHTS DIM, THE CURTAINS OPEN]

T = 0      The universe begins

## ENERGY TURNS TO MATTER

- 0 =  $10^{-43}$  sec.      Energy only, no structure. Temperature above  $10^{30}$  degrees. Energy density about the equivalent of  $10^{41}$  tons per square inch, or something like the pressure exerted by Mount Everest sitting on top of a pin. Gravity, electricity and magnetism non-existent, all in one undifferentiated primal force.
- T =  $10^{-43}$  sec.      First proto-particles appear, as quarks and magnetic monopoles, dots of energy which will later form matter.
- T =  $10^{-36}$  sec.      The universe seems to have ballooned very rapidly to a sphere some hundreds of thousands of miles across in the so-called “inflationary period”.
- T =  $10^{-24}$  sec.      Temperature has dropped to  $10^{20}$  degrees.
- T =  $10^{-6}$  sec.      Protons and antiprotons, possibly neutrinos and anti-neutrinos, emerge but annihilate their partners.
- T =  $10^{-5}$  sec.      Protons and neutrinos, the core of atoms to come, “freeze out” and stabilize.  
Remaining anti-protons and anti-neutrinos disappear into the mysterious quantum vacuum.
- T =  $10^{-2}$  sec.      Temperature has dropped to 100,000,000,000 degrees. The universe is a “soup” of radiation and particles of matter.

T = 1 sec. Electrons and anti-electrons (positrons) appear, but annihilate each other. The temperature has cooled to levels we can replicate in laboratory conditions today.

## THE INGREDIENTS ARE PREPARED

T = 3 minutes The temperature has cooled to a billion degrees. Protons and neutrinos fuse, to create neutrons. Protons and neutrons fuse to create atomic nuclei. Nuclei and electrons fuse to form atoms of hydrogen and helium.

T = 300,000 years Balance of energy in the universe shifts from radiation to matter energy.

T = 500,000 years Temperature has dropped to 3,000 degrees. Hydrogen and helium atoms coalesce to form vast clouds.

T = 1 billion years Galaxies start to separate out.

T = 2.5 billion years Temperature of space has chilled out to 300 degrees. Energy density of space has dropped to  $10^{-20}$  grams per cc.

## THE INGREDIENTS ARE COOKED

T = 4 billion years Hydrogen clouds contract to form first generation of stars.

T = 5-10 billion years Stars and galaxies continue to form. Stars compress under gravity, form new elements, heat up and explode. Clouds of dust, made of complex heavy atoms blow into space, and then start to coalesce - again.

T = 10 billion years Our sun forms, as gravity draws the old star dust particles together.

T = 10.2 billion years Our earth and other solar planets form from the new atomic material.

T = 11-12 billion years      Complex chemicals self-assemble on earth.

## A DEAD PLANET BECOMES ALIVE

T = 12 billion years      Microscopic life appears on earth.

T = 13 billion years      Oxygen rich atmosphere develops, enabling higher forms of life to emerge.

T = 14 billion years      Macroscopic life, large and complex cells, appear.

(Dating now switches to retrospective)

## ANIMAL LIFE EMERGES

(Latin, *animus* = breath, spirit, soul)

T = 14.5 billion years or  
about 450 million  
years ago

First fish appear.

200 million years ago

First mammals appear.

3.5 million years ago

The ape family (hominids) appear.  
*Australopithecus*, the two-legged ape crosses the first barrier.

2.5 million years ago

Man, the toolmaking animal appears (*Homo faber*).

150,000 years ago

Just recognizable man, “the noble animal” (Browning), with rudimentary language appears (*Homo sapiens*).

The second and critical barrier is crossed.

## THE GLOBAL BRAIN AWAKENS

T = 6,000 years ago

*Homo sapiens* invents writing. *Homo sapiens sapiens* shuffles onto the stage.

T = 600 years ago

Printing invented, consciousness spreads and deepens

T = 500 years ago      Proof by geographical exploration that the planet is a sphere. Humankind starts to develop global awareness.

## COUNTDOWN

100 years ago      Radio invented.

90      Einstein shows that matter is concentrated energy:  
 $E = mc^2$

80      The electroencephalograph is invented, showing that consciousness is associated with electrical energy.

70      Edwin Hubble shows that we live in an expanding universe.  
BBC founded, with motto **Nation shall speak peace unto nation.** (Isaiah 82:11)

60      Teilhard de Chardin introduces the term and concept of “noosphere”.

50      Vacuum tube mainframe computer invented.

40      Transistor invented, the chip leads to revolution in information technology.

30      Satellite communication invented.  
Photos from space create consciousness of “spaceship earth”, humankind’s island home.

20      Personal computer invented, our brain enlarged.

10      e-mail and the world wide web invented, the global brain is wired.  
The third barrier looms ahead. *Homo novus*, *Homo globalis* beckons.

## EPILOGUE: WHAT OF THE FUTURE?

*Homo sapiens* is coming to the end of its development, and must change before it destroys the planet and the species. We are now in a race between education and catastrophe, but what are we to learn in order to take the next evolutionary step? Although the answer may not be immediately apparent, we may at least draw some optimism from considering the major steps our species took in the past when, through population pressure, we changed from a hunting animal to an agricultural human. As impending extinction once proved a sufficient incentive to make the first critical step from man the predator towards a new kind of life, a new kind of culture and a new kind of human, so too we may hope that humankind's present crisis will act as an incentive to change. History, we must hope, will repeat itself, or the future will be a new big bang - followed by mushroom clouds and an eternal silence.